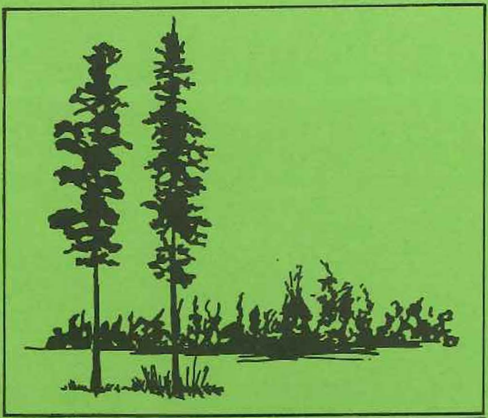
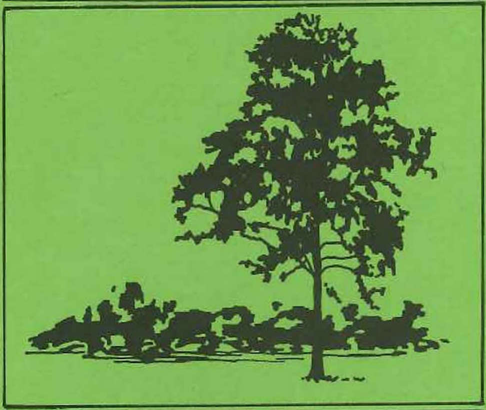
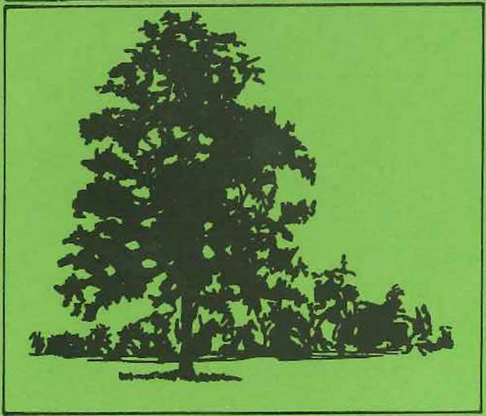
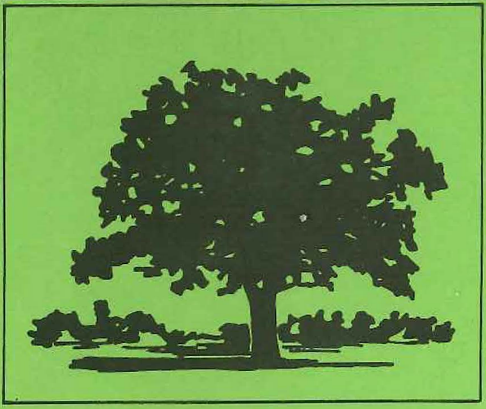

FOREST PEST CONDITIONS IN WISCONSIN

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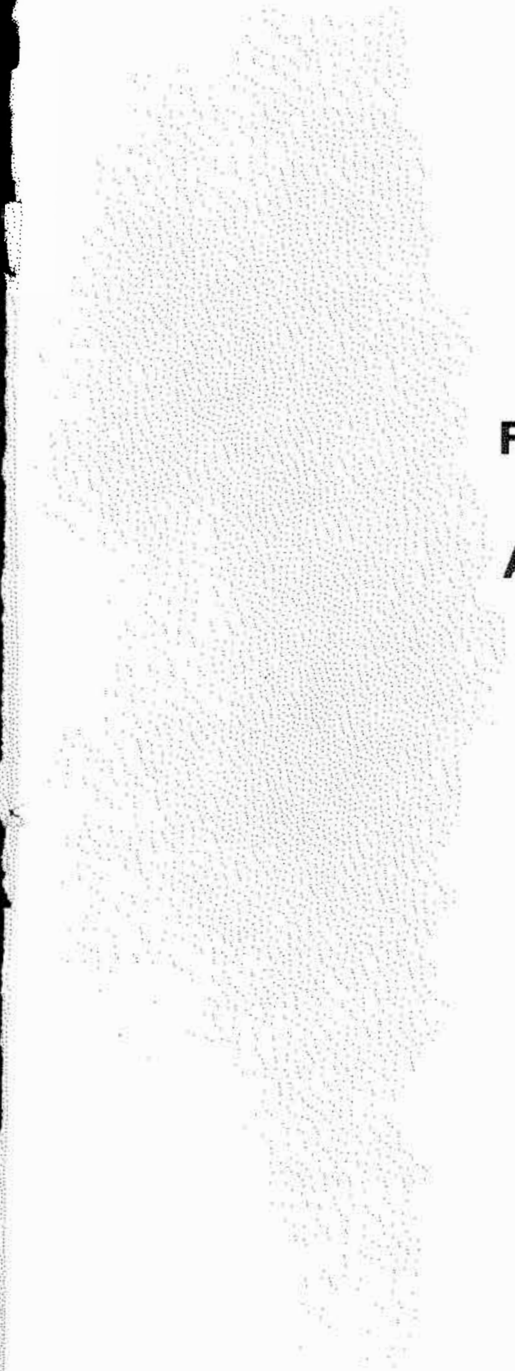

FOREST PEST CONDITIONS IN WISCONSIN

Annual Reports - 1972 & 1973

Compiled and Edited by Donald W. Renlund
Supervisor, Forest Pest Control

DEPARTMENT OF NATURAL RESOURCES
Division of Forestry, Wildlife
and Recreation
Bureau of Forestry

CONTENTS

Page

Forest Pest Survey and Control Personnel. 1
Highlights of Forest Pest Conditions. 2
Major Forest Insects:
Coleoptera. 4
Bronze Birch Borer...Two-Lined Chestnut Borer...Aspen Leaf Beetle...Pales Weevil...Pine Root Collar Weevil...Root Tip Weevil...Elm Bark Beetles...Conifer Bark Beetles...Hemlock Borer...White Grubs...White Pine Weevil

Diptera 6
Balsam Gall Midge...Red Pine Needle Midge

Homoptera 8
Pine Spittlebug...Saratoga Spittlebug...A Pine Bark Aphid...Pine Tortoise Scale...Oak Lecanium...Periodical Cicada...Balsam Twig Aphid

Hymenoptera 11
Introduced Pine Sawfly...Birch Leaf Miner...Elm Leaf Miner...Striped Alder Sawfly...Red-Headed Pine Sawfly...Jack Pine Sawfly...Red Pine Sawfly...European Pine Sawfly...Larch Sawfly...Mountain Ash Sawfly

Lepidoptera 13
Orange-Striped Oakworm...Oak Webworm...Birch Skeletonizer...Large Aspen Tortrix...Spruce Budworm...Jack Pine Budworm...Oak Tortricids...Pine Tussock Moth...Zimmerman Pine Moth...Pine Needle Miner...Oak Defoliator Complex...Aspen Blotch Miner...Eastern Tent Caterpillar...Forest Tent Caterpillar...Gypsy Moth

Orthoptera. 21
Walkingstick...Post Oak Locust

Major Forest Diseases:
Wilts and Diebacks. . . . .
Dutch Elm Disease...Oak Wilt...Butternut Dieback

Root Rots 28
Shoestring Root Rot...Tomentosus Root Rot...Cylindrocladium Root Rot

Foliage Diseases. 30
Brown Spot Needle Blight...Lophodermium Needle Cast...Jack Pine Needle Cast...Spruce Needle Cast...White Pine Needle Blight...Air Pollution

Stem and Branch Diseases. 36
Aspen Shoot Blight...Balsam Fir Canker...Cylindrocladium Canker...Dwarf Mistletoe...Red Pine Shoot Blight...Scleroderris Canker

Page

Miscellaneous 43
Salt damage...Winter Injury...Frost Damage...High Water...
Jack Pine Mortality...Hemlock Mortality...Pine Grosbeak
Damage...Micorrhizae Studies

Appendix A. 46
Red Pine Shoot Blight Damage Survey

Appendix B. 48
Mercury Levels in Trees Near Port Edwards, Wisconsin

Appendix C. 50
Frost Damage - 1972

Appendix D. 51
Injury to Young Trembling Aspen Stems - 1973

Appendix E. 53
Native Elm Bark Beetle Brood Studies, Menominee County - 1972

PREFACE

This report is a compilation of information received from a variety of sources. The combined information for 1972 and 1973 is based largely on reports received from field pest survey and control personnel supplemented by information on forest pest conditions received from other cooperating field personnel in our own and other agencies.

"Thank you" to all who have contributed in any way to the content of the report and in its publication.

Donald W. Renlund, Chief
Forest Pest Survey and Control Section

Department of Natural Resources
Forest Pest Control Personnel - January 1, 1976

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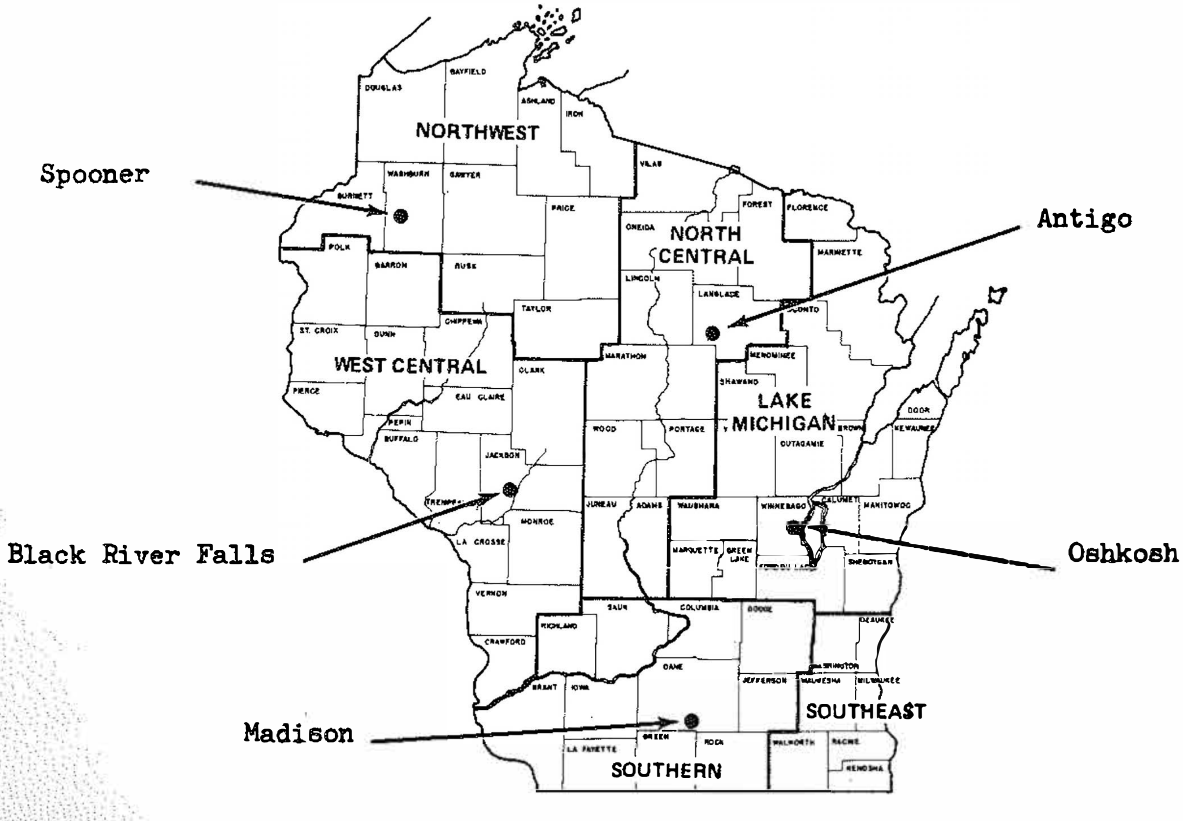
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Highlights of Forest Pest Conditions - 1972 and 1973

The pine root collar weevil continued to kill trees in light, sandy soil areas of northwest and west central Wisconsin, especially in mixed plantings of pines.

Standing diseased dead elms are utilized heavily for breeding sites by the native elm bark beetle in forest areas, and appear to be more of a hazard in disease spread than slash.

Bark beetles building up in slash and blow-down trees in 1972 were checked by favorable moisture conditions and prompt sanitation efforts. They attacked conifers in central Wisconsin that were in low-lying areas flooded in the spring of 1973, balsam fir that was defoliated by the spruce budworm in Oneida County, and summer-cut wood and slash in west central and southwest Wisconsin following an extended dry period in 1973.

Growers had difficulty controlling the gall midge in balsam fir Christmas trees with available insecticides.

Twig and branch mortality, and top-kill occurred on some white pine in northwest Wisconsin in 1972 following severe defoliation in 1971 by the introduced pine sawfly.

Presence of the European pine sawfly in Wisconsin was first verified in 1972. It was collected in Grant, Kenosha, Racine and Walworth counties. The insect appeared to be most active near Burlington in Walworth County. Defoliation was observed on jack, red and Scotch pine.

An infestation of red pine sawfly covered 20,000 acres of jack pine in Adams and Wood counties in 1972. Populations peaked and collapsed the same year.

Elms in Marathon County and western Menominee county were heavily infested by leaf miners in 1973. The public tended to confuse the symptoms with those of Dutch elm disease.

Oak tortricids were associated with widespread defoliation of oaks in Menominee County in 1972 and 1973. Branch die-back and tree mortality occurred in areas with a previous history of defoliation.

Variable defoliation by the large aspen tortrix occurred in aspen stands across the northern counties in 1972 and 1973.

Spruce budworm outbreaks continued in Forest and Oneida counties during 1972 and 1973. Infestations were lighter in the northwest counties.

Jack pine budworm populations were low and little defoliation was apparent in both years.

There was little evidence of the pine tussock moth in areas of previous heavy infestations.

Damage to red pine shoots by the Zimmerman pine moth was conspicuous in central and west central counties.

Walkingsticks were active in a 1000 acre area of jack pine and scrub oak type in Douglas County in 1972. Approximately 1000 acres of forest land were defoliated in Marinette County in 1973 plus a small area in southeastern Menominee County.

Lophodermium needle cast damaged French and Spanish varieties of Scotch pine Christmas trees in central Wisconsin. Newly planted imported nursery stock was found to be infected in a Rock County plantation in 1972.

Red pine shoot blight affected trees on 280 acres of state, county, private and Indian reservation lands, and 5000-8000 acres of Nicolet National Forest land, in northern Wisconsin in 1972. Studies to determine the impact of the disease were started.

Statewide surveys of white pine needle blight were conducted, and a study initiated concerning the relationship between white pine needle blight and atmospheric pollutants using pairs of pollution-susceptible and resistant white pine planted at the U.S. Forest Seed Orchard in southeast Langlade County.

Aspen shoot blight was widespread in 1973 and appears to be a major cause of forking in young aspen stands.

Jack pine needle cast was an important defoliator of stands in southern and central Wisconsin in 1973 leaving only the current year's needles on affected trees.

Presence of Dutch elm disease was confirmed in Barron, Polk and Washburn counties leaving only Bayfield and Iron counties in which the presence of the disease had not been verified by the end of 1973.

The fungus Cylindrocladium scoparium caused stem cankers on several hundred thousand 3-0 white pine seedlings at Boscobel, Griffith and Hayward nurseries in 1972. It caused significant root rot on pines and spruces at the same nurseries in 1973. Studies on control of the fungus were in progress at the University of Wisconsin.

Miscellaneous

Frosts in June, 1972 caused widespread injury to new foliage on conifers and hardwoods in many northern counties. Damage to terminal shoots on young red pine may require cultural treatment in the future. Hardwoods refoliated within a few weeks.

De-icing salt caused severe damage to roadside white and red pine throughout the state. Spruces, maple and birch were also affected.

Winter injury was widespread and severe on Scotch pine (especially the Spanish variety), white spruce and Norway spruce in 1972.

Saturated soil and rising groundwater in the spring of 1973 caused tree mortality in some localities.

Unexplained branch and tree mortality was common in young jack pine reproduction in Adams and Wood counties in 1973 following an extended drought.

MAJOR FOREST INSECTS

COLEOPTERA

Bronze Birch Borer - Agrilus anxius Gory

Ornamental birches were injured and some were killed in Clark, Jackson, Dane, St. Croix and Sawyer counties.

Two-Lined Chestnut Borer - Agrilus bilineatus (Weber)

Branch and top dieback of oak, caused by this insect, were noted in Jackson and Monroe counties. Most dieback was observed in areas where trees had been defoliated by post-oak locust or variable oak leaf caterpillars in 1972.

Aspen Leaf Beetle - Chrysomela crotchi Brown

On May 30, 1972, light defoliation (10%) was apparent on quaking aspen over a 6,000-acre area lying in portions of Langlade and Menominee counties, and beetle larvae were observed skeletonizing leaves. The defoliation was occurring in the same general areas that were infested with large aspen tortrix. These were in T33N, R11&12E (Langlade County) and T30N, R14&15E and T29N, R15&16E (Menominee County).

Pales Weevil - Hylobius pales (Herbst)

Populations of this weevil appeared to be low. No damage was reported or observed on pine seedlings, including Christmas trees. Most susceptible Christmas tree plantings are being protected by residual insecticides being used as treatments for control of root collar weevil, and by better cultural practices in plantations.

Pine Root Collar Weevil - Hylobius radicis Buchanan

Flagging and tree mortality were observed in areas of known infestations in Burnett, Washburn and Douglas counties. In a neglected five-acre, 15 year-old Scotch pine plantation in Washburn County (Section 30, T42N, R12W) 10% of the trees were dead or dying in 1972 and 15% in 1973. The rest of the trees were severly infested.

The weevil is a major pest of Scotch pine on light soils in the west central and central counties where Christmas trees are routinely treated to control it. Feeding injury is commonly found on jack and red pine but little tree mortality results from attacks on these species. In the central counties the weevil is found in association with other Hylobius weevils.

On May 30, 1972, adults were observed in a 200-acre Scotch pine plantation in Wood County (parts of Sections 13, 23, 25, T22N, R6E). Adult feeding injury and characteristic symptoms indicated 100% of the trees were infested. Infestations were severe in other plantations in the vicinity.

Root Tip Weevil - Hylobius rhizophagus Millers

Flagging and tree mortality continued in areas of known infestation in Burnett and Washburn counties. A 12-year-old red pine planting in Washburn County (Section 24, T42N, R13W) showed considerable flagging where trees were adjacent to scattered natural jack pines.

The insect continued to destroy jack pine plantations in the West Central District. It causes flagging and top killing of red pine where it is growing in close association with planted or volunteer jack pine. This indicates an increasing hazard to red pine and a greater incidence of attack on natural-seeded jack pine than has been previously recognized.

Damaged red pine was observed in LaCrosse County (Section 3, T18N, R6W) where five to ten acres were affected, and in Monroe County (Section 26, T18N, R3W) at Camp McCoy. A small private red pine plantation in Jackson County (Section 24, T20N, R2W) had typical damage. In 1972, an infested sixty-six acre jack pine plantation was cut in the Black River State Forest (Section 19, T20N, R4W) to salvage as much merchantable wood as possible. Pre-sale cruise estimates showed 5.5 cords of live wood per acre-plot and 1.4 cords of salvageable dead wood. At the sale price of $8.12 per cord, the return was approximately $56 per acre for the 34-year life of the plantation. Without weevil damage, the volume of timber could have been two or three times as much.

In southern Wood and northern Adams counties the combined activities of root collar and root tip weevils, added to destructive work of other agents, result in severe damage in Scotch pine plantations. Up to 90% of the stand has been killed in some plantations.

Ten percent of the trees were infested in a fifty-acre red pine plantation in Vilas County (SESW Section 32, T42N, R10E). Larval stages were predominant but pupae and adults were observed in the plantation on September 14, 1972. Jack pines were also infested but jack pine is not a preferred host.

Elm Bark Beetles -

Two species of elm bark beetles are active in dissemination of Dutch elm disease in Wisconsin. The smaller Euorpean elm bark beetle, Scolytus multistriatus (Marsham), is the principal vector in the southern half of the state. The native elm bark beetle, Hylurgopinus rufipes (Eichhoff), is the main vector in the northern counties although it occurs statewide (Figure 1). A study of the utilization of elm slash by broods of H. rufipes was conducted in Menominee County (Appendix E).

Conifer Bark Beetles - Ips sp., Pityogenes sp.

In 1972 populations of Ips pini built up on slash from red and jack pine thinnings in Burnett, Douglas, Eau Claire, Jackson and Washburn counties. An abundance of moisture later in the summer apparently prevented the second generation from successfully attacking living trees.

Beetles were found in attacking wind-thrown pines in Oconto and Marinette counties in 1972. Prompt sanitation work prevented buildup.

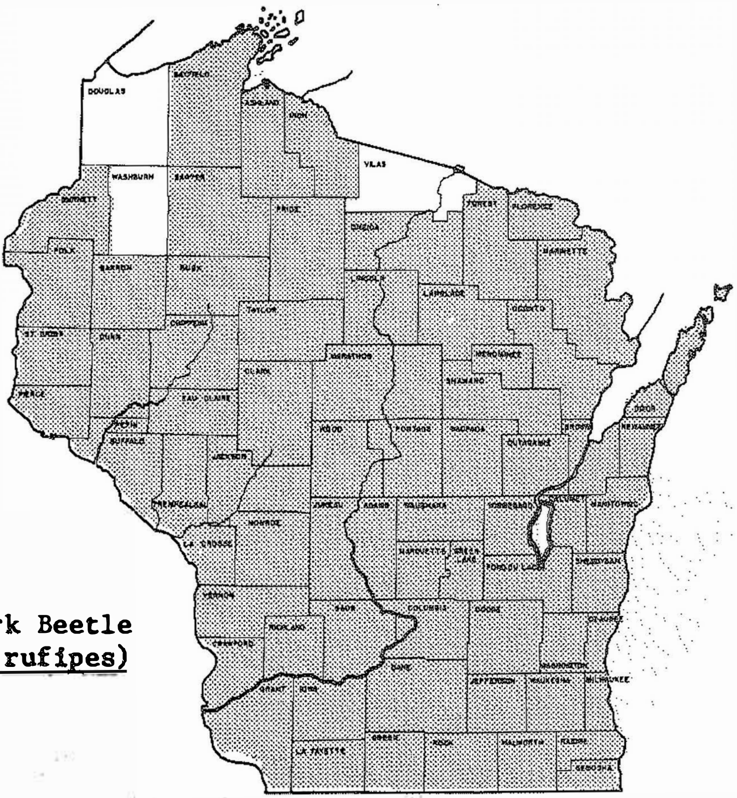
Bark beetle populations were generally down in 1973. Some activity was noted in balsam fir, in Oneida County, which had been severely defoliated by the spruce budworm. Ips sp. beetles were active in west central Wisconsin where pines in low-lying areas had been weakened by flooding during April, May and June. Some buildup occurred in summer-cut wood and slash in west central and southwest Wisconsin following an extended dry period. Pityogenes sp. were found heavily attacking red pine shoots that had been killed by Scleroderris in Vilas County.

Hemlock Borer - Melanophila fulvoguttata (Harris)

Adults were active on fresh hemlock windthrow on July 13, 1972, in Menominee County.

White Grubs - Phyllophaga sp.

Moderate to heavy beetle flights in 1972 were followed by light to moderate seedling mortality in some west central plantations.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GRANT
IOWA
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WAUKESHA
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GREEN
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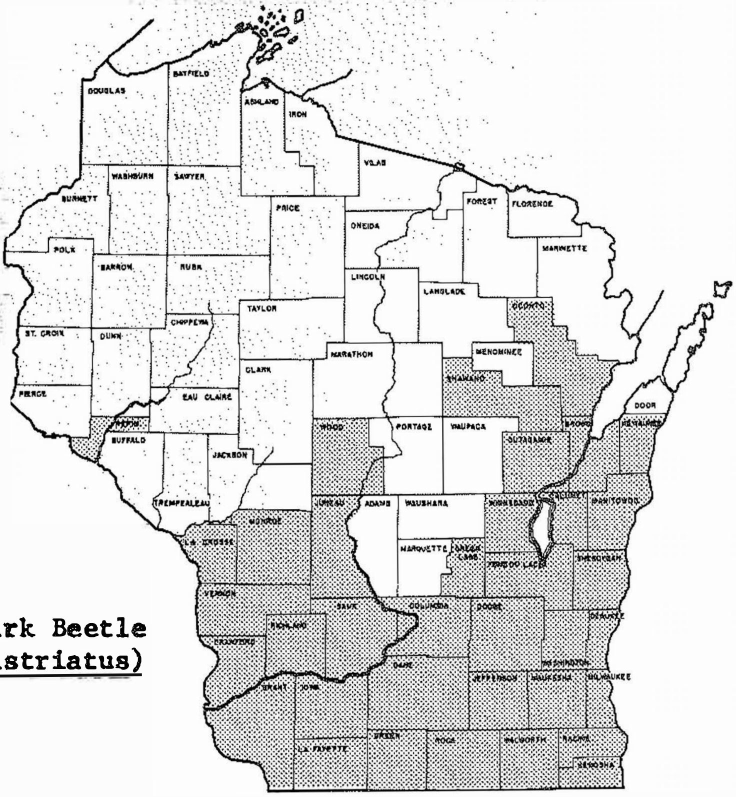
KENOSHA

Native Elm Bark Beetle
(Hylurgopinus rufipes)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JEFFERSON
WAUKESHA
MILWAUKEE
LA FAYETTE
GREEN
ROCK
WALWORTH
RACINE
KENOSHA

European Elm Bark Beetle
(Scolytus multistriatus)

Figure 1. Known distribution of elm bark beetles in Wisconsin - 1972.

A heavy flight of P. tristis reported in Jackson County the week of May 21 defoliated ornamental and pasture oaks (Section 22, T21N, R4W). A loss of 2% - 5% of seedlings resulted from grub feeding in a Black River State Forest plantation (Section 35, T21N, R4W) observed October 5, 1972. Populations were low elsewhere in the state and caused no appreciable damage.

White Pine Weevil - Pissodes strobi (Peck)

Populations increased slightly in the northwestern counties in 1972 and 1973. Up to 1% of white pine leaders observed were weeviled in 1972. Up to 2% of jack pine leaders were weeviled in some stands in Burnett and Washburn counties in 1973.

Some young red pine plantings on Oneida and Vilas counties were 10% weeviled in 1972. This incidence is high but not unheard of for the area. In 1973 Oneida County populations were high in Norway spruce plantings but low in white pine.

Populations in the west central counties were generally unchanged in 1972, but up in 1973. 12% of the terminals in a Clark County Forest white pine plantation (Section 5, T23N, R3W), which had been released by herbicide treatment in 1966, were weeviled in 1972. The incidence was not unusual for open-grown white pine in these counties. In 1973, about 5% of the terminals in some jack pine plantations and up to 20% of the terminals in some white pine and Norway spruce plantations were weeviled. Weeviling was noted in Scotch pine, Norway spruce, and blue spruce Christmas tree plantations.

Insecticides were used to protect 5,400 Christmas trees in Eau Claire, LaCrosse and Monroe counties in 1972.

DIPTERA

Balsam Gall Midge - Dasineura balsamicola (Lintner)

A light to moderate infestation in Washburn County continued to enlarge in 1972 until it covered 5 acres and persisted in the same stand in 1973 (Sections 14 & 15, T38N, R13W). A light infestation occurred in a 3-acre plantation in the same county in 1973 (Section 13, T41N, R12W).

Christmas trees from a northern Chippewa County plantation (Section 2, T32N, R9W) were rendered unsalable by the midge in 1972.

Severe infestations were reported in 1972 and continued in 1973 in balsam fir plantations in Lincoln and Langlade counties. Attempts to control with cygon 2E and malathion when the larvae were in the newly-formed gall failed. Attempts to control in 1973 were also unsuccessful and some Christmas tree growers were becoming concerned over their failures to cope with the insect.

Phenological Notes:

1972

May 16 - Balsam buds beginning to open in the lower crown and new shoots up to ½" long in the upper crown (Langlade County).

May 30 - First galls noted on new growth in Langlade County.

June 21 - Frost damage severe in one plantation, many twigs with newly-formed galls were killed. Several trees exhibited heavy midge activity in the lower crown.

1973

May 22 - Swarming adults abundant, new shoots up to 1-inch long.

May 29 - All traps contained adult midges (Langlade County).

June 4 - Galls readily noted on new needles. Adults no longer present. New shoots ½" to 2 inches long (Langlade County).

Red Pine Needle Midge - Thecodiplosis piniresinosae Kearby

No damage by this midge was reported in 1972 or 1973.

HOMOPTERA

Pine Spittlebug - Aphrophora parallela (Say)

Populations were generally low in 1972 and up slightly in 1973 statewide. In the northwestern counties only one heavy infestation was reported in 1972. Stems white with spittle were observed in a young three-acre jack pine stand in Polk County (Section 8, T36N, R20W). No heavy infestations were found in these counties in 1973 although evidence of the insect was commonly observed.

No infestations were reported in the north central counties in 1972. A few infestations were observed on Scotch pine Christmas trees in Langlade County in 1973. Populations were not high enough to justify control measures, and feeding damage apparently did not reduce commercial value of the trees.

Phenological Note:

June 25, 1975 - Nymphal stages were 75% 3d instars and 25% 4th instars in Langlade County.

Saratoga Spittlebug - Aphrophora saratogensis (Fitch)

Populations were low over the entire state in 1972 and 1973 with the exception of two heavy infestations in red pine in Oneida County (Section 24, T38N, R8E and Sections 22 & 27, T37N, R7E). At the second location, 200 acres were treated by aerial application of ½ pound of malathion in one gallon of #2 fuel oil per acre. Post-spray counts indicated an acceptable level of population reduction.

Nymphal surveys on 600 acres of red pine in 1973 indicated that no chemical treatments were warranted.

Phenological Notes:

June 21, 1972 - Newly emerging nymphs in Lincoln County.

June 22, 1973 - Nymphs 75% 3d instars and 25% 4th instars.

July 26, 1973 - Nymphs mostly in 5th instar in Langlade County.

A Pine Bark Aphid (on red pine)

A pine bark aphid population started a rapid buildup on red pine nursery stock at Hayward Nursery (Sawyer County) in 1972. It was controlled by a natural buildup of lady beetles which became more numerous in the nursery than ever previously observed.

Heavy attacks on plantation red pine, 3' to 6' tall, were reported in 1973 in eastern Vilas County (Section 25, T41N, R11E). Such attacks on red pine are unusual in the area although similar attacks on white pine by *Pineus strobi* (Hartig) are common.

Pine Tortoise Scale - *Toumeyella numismaticum* (Pettit & McDaniel)

Northwest District

High populations were observed on scattered open-grown and small roadside jack pine throughout the northwest counties in 1972 and 1973.

North Central District

Heavy infestations were noted on plantation Scotch pine in Lincoln County (T35N, R7E) in 1972. A compression sprayer application of malathion at ½-pound per acre controlled immature females effectively. Scattered individual young jack pines were heavily infested in Wood County (T01N, R6E).

West Central District

Two heavy infestations were observed in Jackson County in 1972. Trees were blackened and some mortality occurred in a small area of jack pine reproduction (Section 6, T22N, R3W). About 10% of the Scotch pine were heavily infested in a 20-acre Christmas tree plantation (Section 31, T19N, R5W). In this same plantation occasional trees were heavily infested with black pine leaf scale, *Nuculaspis californica* (Coleman), and pine needle scale, *Phenacaspis pinifoliae* (Fitch).

Phenological Note:

June 21, 1972 - Crawlers emerging in Lincoln County.

Oak Lecanium - Lecanium quercifex Fitch

Some twig mortality occurred on scrub oak in Washburn County (T42N, R13W) and Douglas County (T42N, R11, 12, 13W) in 1972.

Periodical Cicada - Magicicada septendecim (Linnaeus)

Adults of the 17-year race of the periodical cicada emerged in June and early July 1973. Cicadas were singing in Sauk and Richland counties on June 9 and 10. Oviposition injury was observed in Dane, Grant, Iowa, Richland, Sauk and Walworth counties. Tree species involved were hard maple, elm, poplars, juniper, basswood, sumac, boxelder, and various species of oak. Oviposition damage was common on trees on south-facing slopes in Grant, Iowa and Sauk counties. More than 6 feet of a single slender elm branch bore a continuous row oviposition punctures. Flagging resulting from oviposition punctures was very common on trees in a number of spots on the bluffs between Boscobel and Prairie du Chien along State Highway 60. Newly-planted maple saplings were severely damaged in the group-camping area in Section 17, just north of the entrance to Wyalusing State Park. No oviposition injury was noted along Fish Hatchery Road, south of Nevin Hatchery, where it had been conspicuous in 1956.

Following are specific locations of cicada sightings or oviposition damage observed in 1973:

Grant County -

SE¼ Section 10, T6N, R4W along town road.
N½, SE¼ and SW¼ Section 17, T6N, R4W in Wyalusing State Park, oviposition damage on maple saplings along trail running east from County Truck "C".

Iowa County -

SE¼, Section 29 and north edge of NE¼, Section 32, T8N, R5E.

Richland County -

NW¼ Section 22, T9N, R1E, east of County Trunk "OO" at Cupp's Spring and Cupp's Vertical Acres.

SE¼ Section 21, T9N, R1E, in vicinity of County Trunk "OO" and town road that runs south through Section 28 toward State Highway 60.

T9N, R1E, along town road where it crosses from Section 27 into Section 34.

Section 26, T9N, R2W, 1½ miles north of State Highway 60 along County Trunk "X", oviposition damage on hard maple.

Balsam Twig Aphid - Mindarus abietinus (Koch)

Two heavy infestations in balsam fir plantations were reported in west central counties in 1972. New shoots were heavily infested early in May in a Monroe County plantation (Section 35, T18N, R2W), but the aphids disappeared before causing needle curling. A Christmas tree plantation in

Clark County (Section 8, T24N, R4W) was sprayed with malathion for the second consecutive year. About 5% of the twigs were infested in a 20-acre balsam fir plantation in Langlade County in 1973 (Section 13, T30N, R12E).

HYMENOPTERA

Introduced Pine Sawfly - *Diprion similis* (Hartig)

Populations were very low over the entire State in 1972. Late generation larvae were abundant enough to be noticeable in the northwestern counties in 1973 but no serious defoliation was reported. There were no reports of defoliation from other parts of the State in 1973.

Birch Leaf Miner - *Fenusa pusilla* (Lepeletier)

Widespread defoliation of ornamental birches was observed from June through September, 1972, in several west central counties. Large areas of forest birch were browned in Clark County.

In 1973, severe defoliation was observed on large areas of Lincoln, Portage and Wood counties, during an aerial survey. Some defoliation of ornamental birches was observed in Spooner (Washburn County) and Hayward (Sawyer County) that same year.

Phenological Notes (Lincoln, Portage and Wood counties):

June 18, 1973 - Most of first generation larvae had dropped to the ground.

July 5, 1973 - Second generation larvae began appearing on new leaves of white birch.

Elm Leaf Miner - *Fenusa ulmi* Sundevall

Heavy leaf mining was observed in elm stands in Marathon, western Menominee and eastern Langlade counties. The public tended to confuse the symptoms with those of Dutch elm disease, also present in early July.

Striped Alder Sawfly - *Hemichroa crocea* (Fourcroy)

The population in Douglas County (Section 25, T44N, R10W) which had caused severe defoliation in 1970, and much less defoliation in 1971, collapsed in 1972 when it produced no noticeable defoliation. However, moderate to severe defoliation was observed on the same area in 1973.

Red-Headed Pine Sawfly - *Neodiprion lecontei* (Fitch)

Populations were very low over the entire State in both 1972 and 1973. Egg and early larval surveys were conducted in areas with a history of infestation. None were found in Forest, Langlade and Menominee counties. Only a few infested needle clusters were found in a windbreak in Langlade County.

Phenological Note:

July 6, 1973 - 25% of the eggs observed in Langlade County had hatched.

Jack Pine Sawfly - Neodiprion pratti banksianae Rohwer

No serious defoliation occurred in 1972 or 1973. As in previous years, a few scattered colonies were found in jack pine stands in Douglas County (T44N, R11W and T45N, R10W).

Red Pine Sawfly - Neodiprion nanulus nanulus Schedl

The outbreak in Adams and Wood counties continued in 1972 (T20N, R6E and T21N, R5 & 6E). About 20,000 acres of jack pine were defoliated to varying degrees. Defoliation in red pine plantations was hardly apparent. Severe defoliation was most evident on trees with small crowns in shelterwood cuttings. An egg survey in October 1972 indicated almost complete collapse of the population. Twenty-five terminal shoots were examined on each of 68 trees cut. A total of 3 egg batches were found.

A larval survey in late May, 1973, revealed only a few colonies on 20 plots.

May 20, 1972 - Larval stages observed in Adams and Wood counties were 20% 2nd instars, 60% 3d instars and 20% 4th instars.

June 5, 1973 - Larvae predominantly in 3d instar; a few colonies in 2nd.

June 14, 1972 - 99% of larvae had cocooned.

European Pine Sawfly - Neodiprion sertifer (Geoffroy)

Larvae, identified as Neodiprion sertifer, were collected from several locations in 1972, most of them in Walworth County. Collections were also made in Grant, Kenosha and Racine counties. These provided the first records of the insect's presence in Wisconsin. Defoliation was observed on jack, red, and Scotch pines in plantations and windbreaks. The appearance of some of the red pine examined and distribution of infested areas indicated that the sawfly has likely been present in Wisconsin for at least one year and very likely longer. Its defoliation may have been mistaken for that of Neodiprion nanulus nanulus or other sawflies that feed exclusively on old foliage. In 1973 adult males of N. sertifer were caught in pheromone traps in Jefferson, Rock and Waukesha counties.

For more detailed information see:

Benjamin, D. M., D. W. Renlund, and P. W. Smith. 1973. The European pine sawfly, Neodiprion sertifer (Geoffroy), a new threat to Wisconsin's pine forests. University of Wisconsin Forestry Research Note 171, 3 p.

Larch Sawfly - Pristiphora erichsonii (Hartig)

Oviposition injury was very noticeable in many stands in the northwest counties in 1972 but subsequent defoliation failed to materialize. Only a few scattered stands were moderately to severely defoliated. Populations declined further in 1973 when no severe defoliation was noted and only a few tamarack stands were lightly to moderately defoliated.

Mountain-Ash Sawfly - Pristiphora geniculata (Hartig)

Defoliation of ornamentals was common in Langlade, Oneida, Sawyer, Vilas and Washburn counties in 1972 and 1973. A partial second generation was noted in the northwest counties.

LEPIDOPTERA

Orange-Striped Oakworm - Anisota senatoria (Doubleday)

Many moths were observed on July 12, 1972, at Willow River State Park (Section 9, T29N, R19W, St. Croix County). Late-instar larvae were observed on September 14 in the same area. Light defoliation had occurred on some trees and caterpillars were a minor annoyance to some campers.

Oak Webworm - Archips fervidanus (Clemens)

Only an occasional colony was noticed on scrub oak in Burnett, Douglas and Washburn counties in both 1972 and 1973.

Birch Skeletonizer - Bucculatrix canadensisella Chambers

High populations in the north central counties collapsed in 1972 and remained low in 1973 except for an area in central Forest County.

Large Aspen Tortrix - Choristoneura conflictana (Walker)

Several thousand acres of aspen were heavily defoliated in central Menominee County (T29, 30N; R15, 16E (Figure 2) and in central Langlade County (T32N, R12E) in 1972 and 1973.

Noticeable defoliation of aspen also occurred in northern Douglas County (T47, 48, 49N; R10, 11, 12, 13, 14W) and northern Bayfield County (T47, 48, 49, 50, 51N; R5, 6, 7, 8, 9W) in both years. Some defoliation was reported on Madeline Island in 1972.

Phenological Notes:

1972

May 30 - 80% larvae, most of them mature, and 20% pupae in Menominee County.

June 12 - Thousands of moths present in aspen stands in Langlade County.

June 20 - Moth flight past peak in Menominee County. A few mating pairs were observed.

1973

May 14 - Larvae in second instar; aspen leaves 25% in bud stage; other leaves 3/4" long (Menominee and northeast Langlade counties).

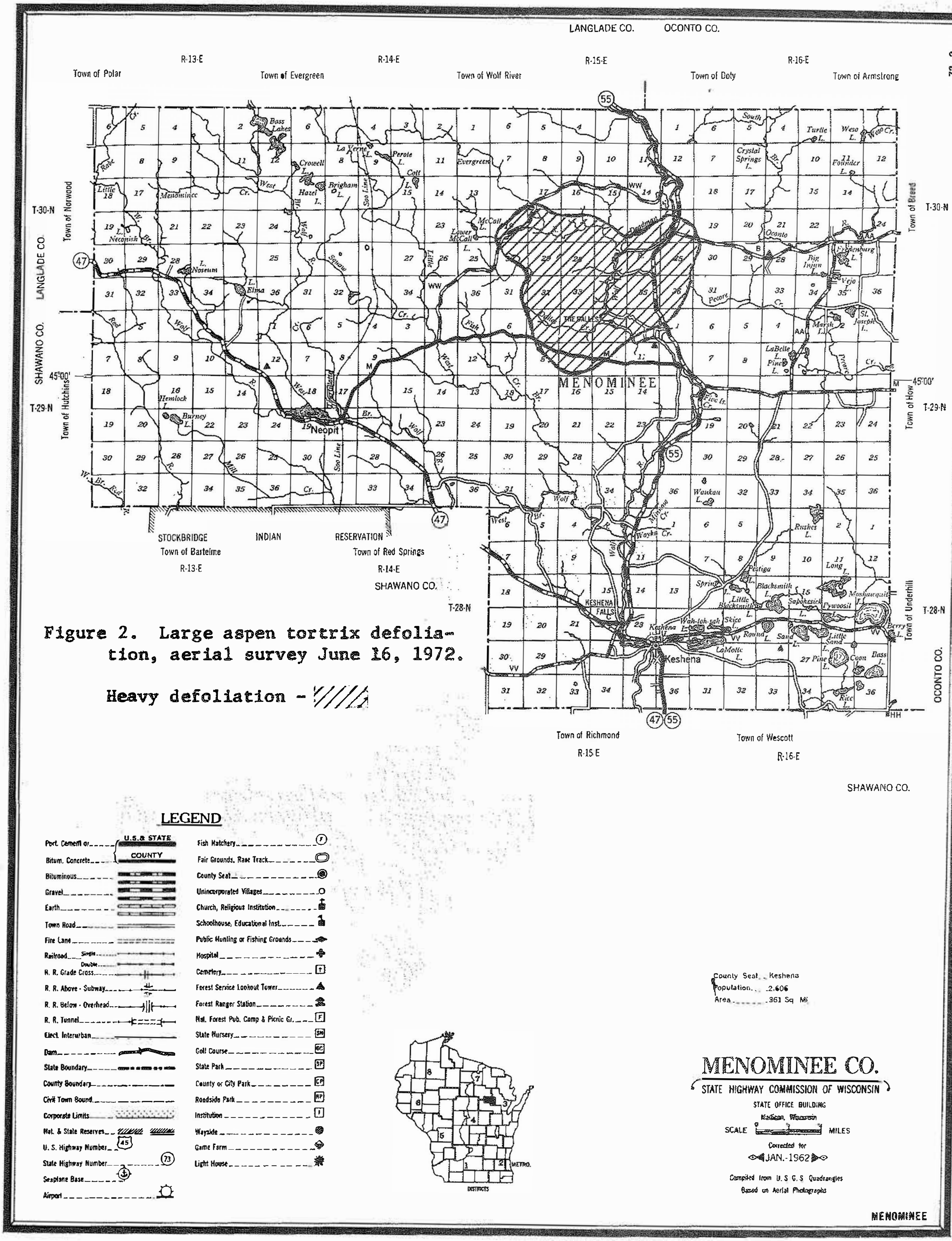

LANGLADE CO.
OCONTO CO.
R-13-E
R-14-E
R-15-E
R-16-E
Town of Polar
Town of Evergreen
Town of Wolf River
Town of Doty
Town of Armstrong
72-3
MENOMINEE
T-30-N
T-29-N
T-28-N
Town of Norwood
Town of Hutchins
Town of Breed
Town of How
Town of Underhill
LANGLADE CO.
SHAWANO CO.
45°00'
MENOMINEE
THE FALLS
Neopit
Keshena
KESHENA FALLS
STOCKBRIDGE
INDIAN
RESERVATION
Town of Bartelme
Town of Red Springs
SHAWANO CO.
Town of Richmond
Town of Wescott
SHAWANO CO.
OCONTO CO.
LEGEND
County Seat - Keshena
Population - 2,606
Area - 361 Sq. Mi.
MENOMINEE CO.
STATE HIGHWAY COMMISSION OF WISCONSIN
STATE OFFICE BUILDING
Madison, Wisconsin
SCALE
MILES
Corrected for
JAN.-1962
Compiled from U. S. G. S. Quadrangles
Based on Aerial Photographs
DISTRICTS
METRO.
MENOMINEE

Figure 2. Large aspen tortrix defoliation, aerial survey June 16, 1972.

Heavy defoliation - ▨

May 21 - Larvae 75% 2nd instar, 25% 3d instar. Aspen leaves up to 1" long in Langlade County.

May 31 - Larvae predominantly in the 4th instar, a few 3d instars present. Aspen leaves 90% expanded, webbing and rolling of leaves conspicuous in Menominee County.

June 6 - Larvae 25% 4th instar, 75% 5th instar. Aspen leaves fully grown in Menominee County.

June 12 - Late larvae 25%, pupae 75% in Menominee County.

June 14 - Pupation well underway in northern Douglas County.

June 20 - Adults 60%, pupae 40% in Langlade County.

Spruce Budworm - Choristoneura fumiferana (Clemens)

The outbreak in mature balsam fir and spruce, dating back at least three years, on industrial forest land in Oneida County (T35, 36, 37N; R11E) persisted in 1972 and 1973. A severe frost in early June, 1972, contributed to a continuing decline in tree condition. In 1973 defoliation was heavy (40%+) on 4,000 acres of timber, moderate (20% - 40%) on 3,750 acres and light on 4,000 acres based on aerial surveys. A 35-year-old white spruce plantation, about 100 acres in size, was moderately to severely defoliated in 1972 (Section 28, T37N, R14E). Similar defoliation occurred on 800 acres of white spruce plantations in 1973.

Spruce budworm egg counts in 1973 were 5 times greater than in 1972 in Oneida County, and there was little evidence of parasitism. Salvage cutting was being done in areas of heavy defoliation and poor stand vigor. Feeding was generally light on most spruce-balsam fir stands in Bayfield, Douglas, Sawyer and Washburn counties in 1972 and 1973. Moderate defoliation occurred on 600 acres of timber in Washburn County in 1972 for the third consecutive year, but eggs were scarce and the population declined. Egg counts in 1973 were high in one stand in Bayfield County (Section 34, T44N, R8W) providing the potential for severe defoliation in 1974.

Phenological Notes:

1972

June 6 - Larvae 10% 3d, 50% 4th, 40% 5th instars in Oneida County.

July 20 - Egg masses 85% hatched. 20% of egg masses contained parasitized eggs.

1973

May 15 - Spruce buds dormant, no larvae noted in Forest County.

May 24 - Larvae predominantly 2nd instar. New spruce shoots 1/2" long with bud caps intact; balsam fir shoots up to 3/8" long and bud caps shed.

June 1 - Larvae predominantly 3d instar. New spruce shoots up to 1" long, 60% of bud caps still remain attached. 116 shoots out of 350 infested (Forest County).

June 21 - Late instar larvae 70%, pupae 30%. 30% - 90% defoliation on 5000 acres (Oneida County).

June 25 - About 98% pupae in spruce plantations in Forest County. A few _Apanteles_ cocoons in webbing.

July 3 - Adults swarming by the thousands, primarily in tree tops, at 11:00 a.m., CDST. Many mating pairs of moths. Temperature about 80°F near ground level. A few _Itoplectis_ observed (Oneida County).

July 18 - No budworm adults present; nearly all eggs hatched, larvae in first instar (Forest County).

Jack-Pine Budworm - _Choristoneura pinus_ (Freeman)

Low early larval counts were further reduced by noticeable parasitism so that little defoliation occurred in the northwest counties in 1972. Egg counts were also low. The 1973 larval counts were the lowest in many years and very little defoliation was noted throughout the jack pine type. Larval and pupal parasitism were again evident in 1973 and egg counts were generally low.

Populations were extremely low in the north central and west central counties in 1972 and 1973. Jack pine staminate flower production was heavy in the north central counties.

A small field test was conducted in Douglas County in 1972 using a mistblower to apply _Bacillus thuringiensis_ Berliner for control of the budworm. The Dipel provided by Abbott Laboratories, Libertyville, Illinois, produced results that indicated the material should be given further consideration. In 1973 another mistblower application of _B. thuringiensis_ was made under adverse conditions. Gusty winds made consistent coverage difficult. Thuricide 16B, provided by Sandoz-Wander, Inc., was applied at 1½ quarts, in enough water to make a gallon of spray mixture, per acre. Post-spray checks indicated that good control is possible if adequate spray coverage is attained. Six days after application, mortality, adjusted for natural control, was 81.2%. Ten days after application mortality had increased to 86.8%.

In 1972, a two-year-old red pine planting on a 40-acre tract that had been completely cleared of jack pine in Douglas County was infested by budworm larvae which apparently had been dispersed from the large jack pine around the edges of the opening. From 1 to 3 larvae were found on each young red pine.

Phenological Notes:

_1972_

May 17 - First larvae found in Douglas County. Pj leaders 1"-4" long, pollen hard and green. Oak buds starting to break.

May 25 - Most larvae out of hibernation in all counties and feeding. Pollen ripe and shedding. Pj leaders 3"-10" long. Red pine leaders 2"-4" long.

May 30 - Some 3rd instar larvae in Washburn and southern Douglas Counties. Pollen gone. Jack pine leaders 4"-10" long.

Most larvae in 3rd instar in Wood County.

June 8 - Larvae in 3rd instar in Vilas County.

June 9 - Larvae ranged from 2nd to 5th instars in Douglas County.

June 12 - Some 6th instar larvae in Douglas County. Apanteles starting to show.

June 16 - First pupae in Polk and southern Burnett County.

June 19 - First pupae in Douglas County (T45N, R10W).

June 27 - Budworm 30% pupated in northern Burnett and southern Douglas counties.

July 6 - About 60% pupated and first adults in southern Douglas County.

July 10 - Adults common in northern Douglas and Bayfield Counties.

1973

May 21 - First larvae found in Douglas County. Pj leaders 2"-6" long, pollen hard and green.

May 29 - Most larvae out of hibernation in all counties and feeding. Pollen starting to ripen. Pj leaders 4"-10" long.

June 1 - Larvae still small 2nd instar in Douglas County. Pollen ripe and blowing in clouds. Pj leaders 6"-10" long.

June 5 - Larvae still 2nd instar in Bayfield County. Pollen all gone.

June 12 - Larvae 2nd and 3rd instars in Bayfield County. Pj leaders 6"-12" long.

June 22 - Larvae 4th and 5th instars in northern Washburn and southern Douglas County.

June 29 - First pupae in Douglas County (T45N, R10W).

July 6 - Eggs 25% hatched in Langlade County.

July 9 - About 95% pupated in Douglas and Bayfield counties. Some adults in Douglas County.

July 11 - About 90% of adults emerged in Douglas County. Only about 10% emerged in western Bayfield County.

Oak Tortricids

The oak leaf tier, Croesia semipurpurana (Kearfott), has been associated with extensive defoliation, top-kill and mortality of red oak (Quercus rubra) in Menominee County during 1971, 1972 and 1973. Previous mortality was evidenced by the fallen dead saplings and pole-size red oak on the ground in the area where most recent defoliation had been concentrated. Severe defoliation of northern pin oak, Quercus ellipsoidalis, occurred during the same period, but the defoliator was not reared and identified from field collections as was done in the red oak type. Suspect is the fruit tree leaf roller, Archips argyrospilus, which was identified as the defoliator of northern pin oak in the same general area in 1967. Defoliated areas were mapped during aerial and ground surveys conducted in 1972 and 1973 (Figure 3). Observed defoliation during 1973 covered approximately 4,500 acres of red oak, mostly in the southwest part of T30N, R16E, and 8,000 acres of northern pin oak, mostly between State Highway 55 and the old South Branch Road. Mortality and top-kill were confined to about 700 acres of red oak in Sections 19, 20, 29 and 30, T30N, R16E. A small beetle, Pseudopityophthorus minutissimum (Zimmerman), was commonly found tunneling around the circumference of dead and dying oak branches.

Three impact plots, each 1/5-acre in size, were established in the area to document current conditions, and provide a basis for evaluating subsequent changes. All the red oaks were tallied by dbh, crown-class, percent top-kill, defoliation, old and new mortality, basal cankers associated with Armillaria mellea, and frost cracks or old fire scars. Trees were numbered with white paint for future reference and plot locations were mapped.

Phenological Notes (Red Oak Type):

May 22 - First instar larvae mining and webbing buds and new leaves. Red oak leaves up to 3/4" long.

May 31 - Third instar larvae feeding and webbing leaves. Estimated 40% defoliation. Leaves up to 2½" long.

June 10 - First observation of larvae "ballooning" very abundantly. Also migrating up and down tree trunks.

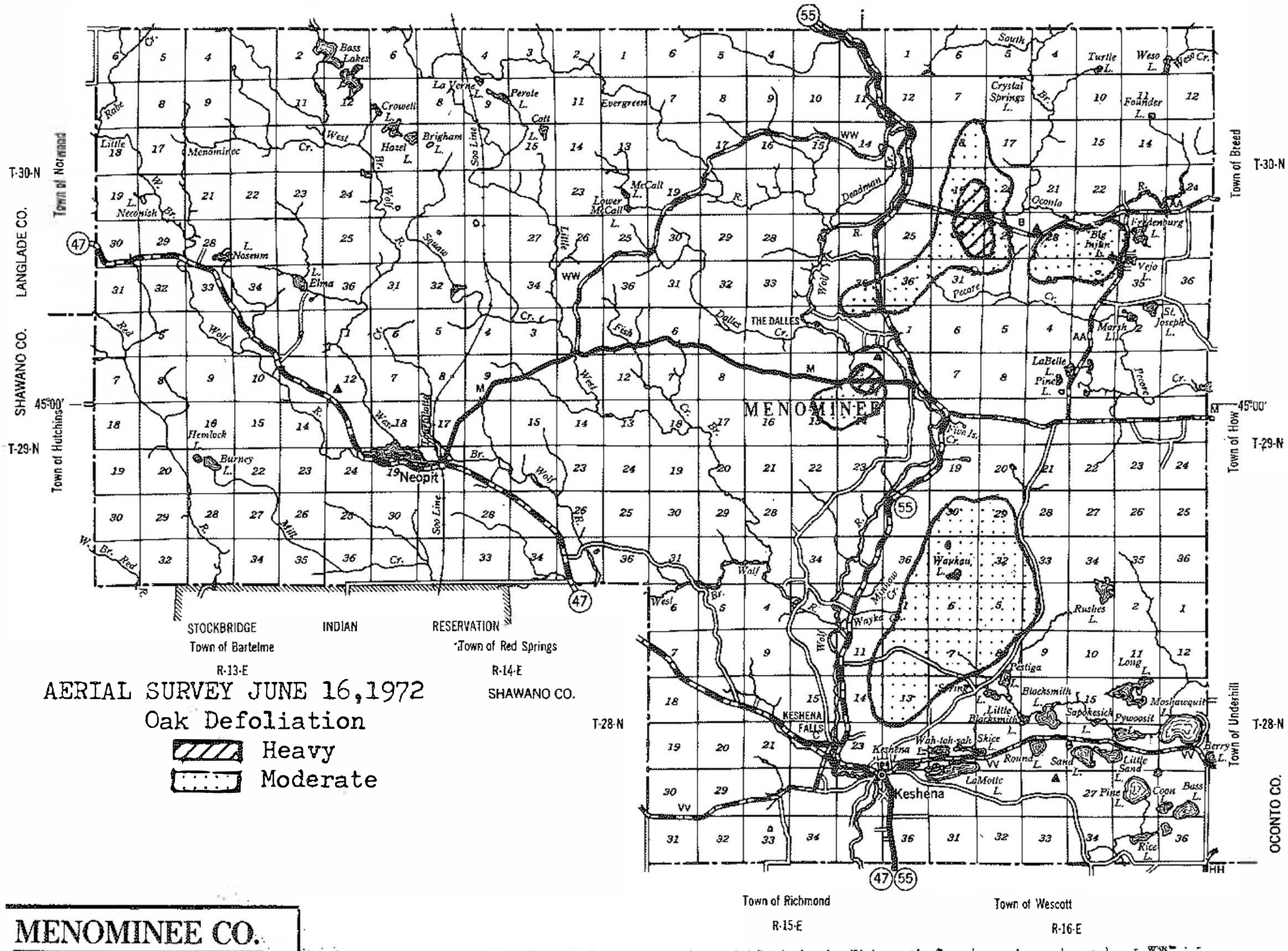
June 12 - Sheaths of webbing cover trunks and limbs of large red oaks. Larvae still"ballooning". Feeding about over as few larvae found in webbed leaves.

June 15 - "Ballooning" largely ended. 90% pupae, largely in litter, but some in bark cracks and caught in webbing.

June 18 - Pupae 95%. No longer any evidence of feeding.

June 20 - First moths collected from rearing boxes.

June 29 - Moths very abundant in oak type. Some trees beginning to refoliate.


AERIAL SURVEY JUNE 16,1972
Oak Defoliation
▨ Heavy
⬚ Moderate
MENOMINEE
Neopit
Keshena
KESHENA FALLS
THE DALLES
STOCKBRIDGE INDIAN RESERVATION
Town of Bartelme
Town of Red Springs
Town of Richmond
Town of Wescott
Town of Norwood
Town of Hutchins
Town of Breed
Town of How
Town of Underhill
LANGLADE CO.
SHAWANO CO.
OCONTO CO.
T-30-N
T-29-N
T-28-N
R-13-E
R-14-E
R-15-E
R-16-E
45°00'
MENOMINEE CO.

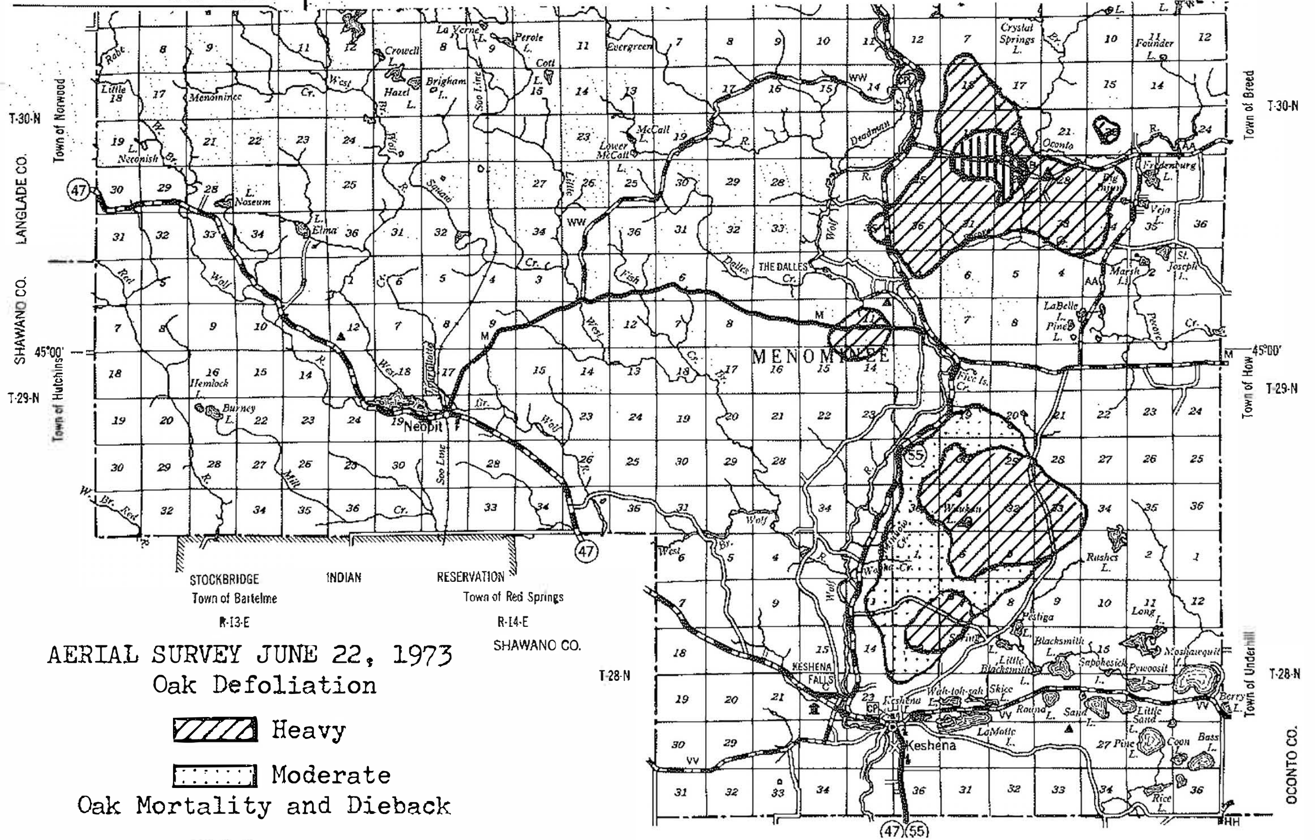

AERIAL SURVEY JUNE 22, 1973
Oak Defoliation
▨ Heavy
⬚ Moderate
Oak Mortality and Dieback
▥ Heavy
MENOMINEE
Neopit
Keshena
KESHENA FALLS
THE DALLES
STOCKBRIDGE INDIAN RESERVATION
Town of Bartelme
Town of Red Springs
Town of Norwood
Town of Hutchins
Town of Breed
Town of How
Town of Underhill
LANGLADE CO.
SHAWANO CO.
OCONTO CO.
T-30-N
T-29-N
T-28-N
R-13-E
R-14-E
45°00'

Figure 3. Defoliation by oak tortricids in 1972 and 1973 and associated oak mortality.

MENOMINEE CO.

SHAWANO CO.

July 9 - Moths less abundant in oak type. Trees largely refoliated.

July 26 - Moths no longer observed. No evidence found of egg laying. Refoliation complete on most red oaks.

Pine Tussock Moth - Dasychira plagiata (Walker)

Populations in Doublas and Washburn counties which had been high in 1971, virtually disappeared in 1972 and continued at a very low density in 1973. Three small egg masses were found during the annual egg survey in 1972, and none were found in 1973.

Zimmerman Pine Moth - Dioryctria zimmermani (Grote)

A red pine plantation in northeast LaCrosse County (Section 8, T18N, R6W) and nearby shelterbelts contained large numbers of shoots damaged by this insect in 1972.

Pine Needle Miner - Exoteleia pinifoliella (Chambers)

Browning of jack pine foliage by this insect was evident in Washburn County (T42N, R18W) in 1972 and 1973, and in Douglas County (T43N, R13W) in 1973.

Oak Defoliator Complex:

Variable Oak Leaf Caterpillar - Heterocampa manteo (Doubleday)
Red-Humped Oakworm - Symmerista canicosta Francelmont
Orange-Humped Mapleworm - Symmerista leucitys Francelmont

The heavy populations of 1971 collapsed completely in the northwest counties in 1972 and no defoliation was observed there. Light to moderate defoliation of oak occurred in parts of Washburn County in 1973, and larvae were observed in Bayfield, Burnett and Douglas counties but no defoliation was reported. No areas of oak were defoliated in the west central counties in 1972. Some overwintered pre-pupae were found in 1972 in areas of 1971 defoliation. The largest single area of near-complete defoliation occurred near Saddle Mound in Jackson County in 1973. Nearly 6000 acres of scrub oak, on parts of 5-6 sections, were stripped of foliage.

Aspen Blotch Miner - Lithocolletis tremuloidiella Brown

Heavy infestations continued in the north central counties in 1972 and 1973. Several thousand acres in central Vilas and north central Oneida counties were heavily infested.

Phenological Notes:

July 12, 1972 - Larvae in mined leaves.

July 11, 1973 - Well developed larvae present in leaves. Infested foliage beginning to discolor.

Eastern Tent Caterpillar - Malacosoma americanum (Fabricius)

Scattered tents were observed in the northwest and west central counties in 1972 and 1973.

Forest Tent Caterpillar - Malacosoma disstria (Hubner)

Neither larvae nor defoliation caused by them were observed in the state in 1972 or 1973. Egg surveys both years produced no eggs.

Gypsy Moth - Porthetria dispar (Linnaeus)

Following the catch of a single male gypsy moth in a trap at Mill Bluff State Park (Monroe County) in 1971 a statewide cooperative trapping program was conducted in 1972 and 1973 in cooperation with the Wisconsin Department of Agriculture and the U.S. Department of Agriculture - Animal and Plant Health Inspection Service (APHIS) (Figure 4). No additional male moths were caught in the disparlure-baited traps.

ORTHOPTERA

Walkingstick - Diapheromera femorata (Say)

Moderate numbers of walkingsticks were present on about 1,000 acres of jack pine - scrub oak type (Quercus ellipsoidalis) in Douglas County (Sections 30 and 31, T43N, R13W), in 1972. Light to moderate defoliation occurred mainly on scrub oak and hazel brush. Only occasional walkingsticks were observed in the north central counties.

A few walkingsticks were observed at scattered locations in Burnett, Douglas, Sawyer and Washburn counties in 1973. High populations caused severe defoliation of scrub oak and hazel in southeast Menominee County. 45 acres of scrub oak were defoliated in Marinette County (NW¼, SW¼, Section 12, T34N, R17E) in 1972, and the odd-year infestation (1973) covered an area of 1,000 acres, including parts of Sections 17, 18, 19, 20, 30 and 31, T32N, R19E. Another infestation occurred in Section 27, T33N, R19E. Walkingsticks in combination with D. quercus caused variable defoliation of oaks and other trees in Sections 13, 24, 25 and 36, T32N, R18E.

Post Oak Locust _ Dendrotettix quercus (Packard)

Populations were very low throughout the state in 1972. A square mile of scrub oak (Quercus ellipsoidalis E. J. Hill) was defoliated by this insect in Marinette County in 1973 (Section 24, T33N, R19E). The area was next to a large area infested by walkingsticks. Populations were also high in Adams, Monroe, and Jackson counties where defoliation in some areas ranged from 25% to 50%. The grasshoppers in these counties were frequently found in areas where the variable oak leaf caterpillar had been active and undoubtedly contributed to the defoliation attributed to the caterpillars.

Phenological Notes:

1973
June 26 - Grasshoppers 5/8" to 7/8" long at Bell Mound (Jackson County).
June 27 - Grasshoppers average 3/4" in length at Saddle Mound (Jackson County).
June 27 - Defoliation starting to become apparent 3 miles east of Millston in Jackson County.

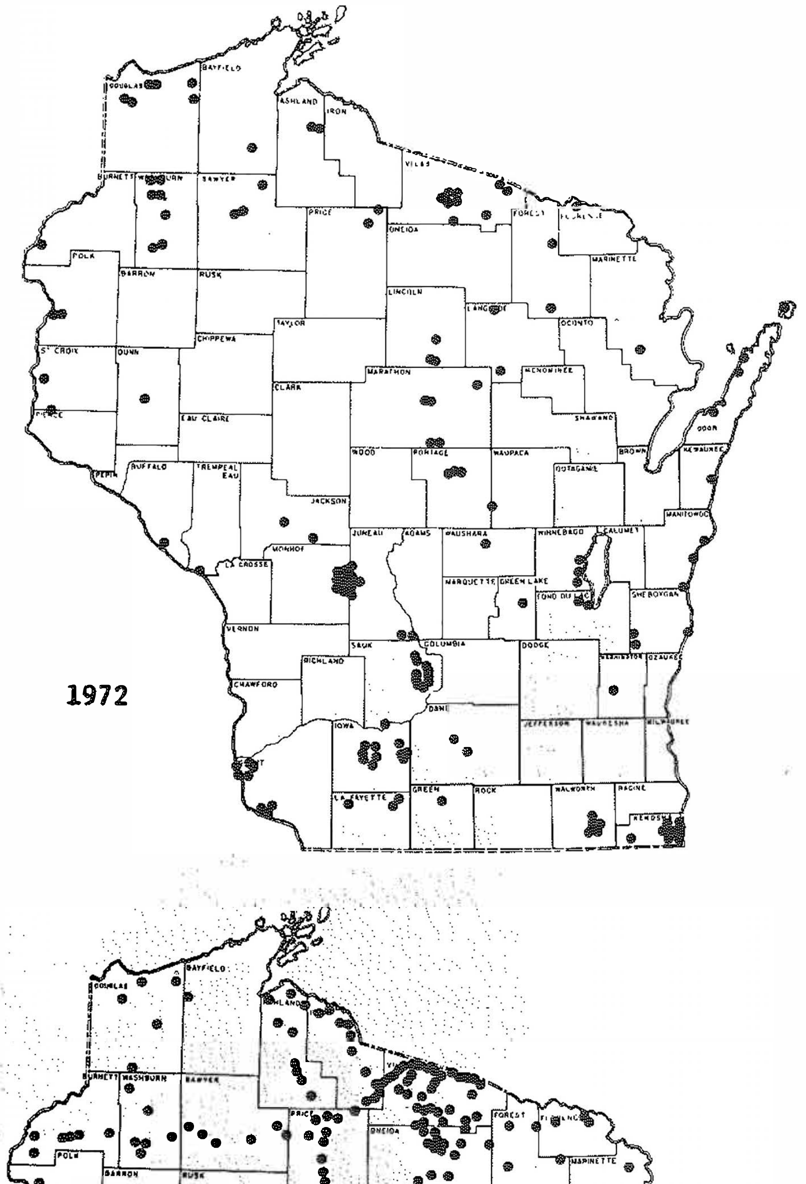

1972
1973
DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
BURNETT
WASHBURN
SAWYER
PRICE
ONEIDA
FOREST
FLORENCE
MARINETTE
POLK
BARRON
RUSK
LINCOLN
LANGLADE
OCONTO
TAYLOR
ST CROIX
DUNN
CHIPPEWA
MARATHON
MENOMINEE
CLARK
PIERCE
EAU CLAIRE
SHAWANO
DOOR
WOOD
PORTAGE
WAUPACA
BROWN
KEWAUNEE
PEPIN
BUFFALO
TREMPEALEAU
OUTAGAMIE
JACKSON
MANITOWOC
JUNEAU
ADAMS
WAUSHARA
WINNEBAGO
CALUMET
MONROE
LA CROSSE
MARQUETTE
GREEN LAKE
FOND DU LAC
SHEBOYGAN
VERNON
SAUK
COLUMBIA
DODGE
WASHINGTON
OZAUKEE
RICHLAND
CRAWFORD
DANE
IOWA
JEFFERSON
WAUKESHA
MILWAUKEE
GRANT
LA FAYETTE
GREEN
ROCK
WALWORTH
RACINE
KENOSHA

Figure 4. Distribution of gypsy moth traps in Wisconsin.

MAJOR FOREST DISEASES

WILTS AND DIEBACKS

Dutch Elm Disease - *Ceratocystis ulmi* (Buisman) Moreau

1972

Dutch elm disease has been known to be present in Wisconsin since 1956 and is found in 67 of Wisconsin's 72 counties. It was confirmed in 1972 for the first time in Barron, Polk and Washburn counties.

An estimated 75% of the lowland elms have been infected or killed throughout Menominee County, and little of it has been harvested primarily because of small size and low quality. Intensification of the disease in the county over a six-year-period is directly related to elm density. The pattern of disease intensification is similar to that elsewhere in the state. Between 25% and 50% of the elms around openings such as fields, or along roads are also dead or dying. The mortality in this type of situation is confined mostly to younger age classes or large elms with low crowns.

Infected trees are apparently present in every section in Menominee County that contains some elm. Infection in the northern hardwood type is most severe where they abut the lowland elm type. Average infection of sawlog trees is estimated at less than 1% so far, but in local spots may reach 10%. Intensification appears to be moving westward in the county from the Wolf River drainage and northward from the southern boundary. Infected sawlog elms have now been noted in nearly every cutting compartment of the forest. Although disease intensification in the high value northern hardwood type is unpredictable, it is apparent that it will be much slower than the rate that occurred in the lowland elm types the past six years.

1973

Dutch elm disease is now present in 70 of Wisconsin's 72 counties. Bayfield and Iron counties are the remaining areas where the disease has not been confirmed (Figure 5). Dutch elm disease has increased dramatically in northern Wisconsin the past two years. An estimate of elm mortality was made in each county by DNR Forest Entomologists in 1973 (Figure 6). Millions of potentially merchantable sawtimber trees are dead or dying from the disease. Many of these trees could be salvaged for lumber.

A meeting of State and Federal agency representatives involved with Dutch elm disease problems in urban and forest areas was held in Madison on November 20, 1973. It was held to discuss the status of the disease, statewide, and what might be done about utilization of diseased trees to minimize the impact of the disease that was occurring in both urban and rural areas.

Agencies participating in the meeting were the Departments of Natural Resources, Agriculture, University of Wisconsin - Madison and the U.S. Forest Service. The consensus of the group, which included entomologists, plant pathologists, foresters, wood utilization experts and extension personnel was that on-going sanitation programs be continued. Stipulations on the movement and utilization of diseased elm wood which were considered to be

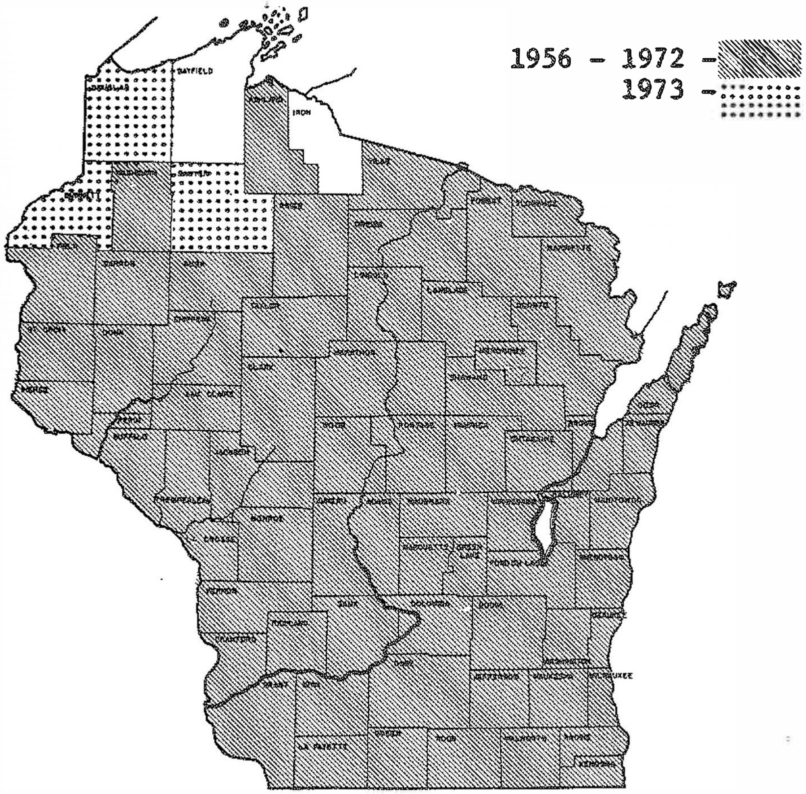

1956 - 1972 - ▨
1973 - ⁙

Figure 5. Known distribution of Dutch elm disease in Wisconsin - 1973.

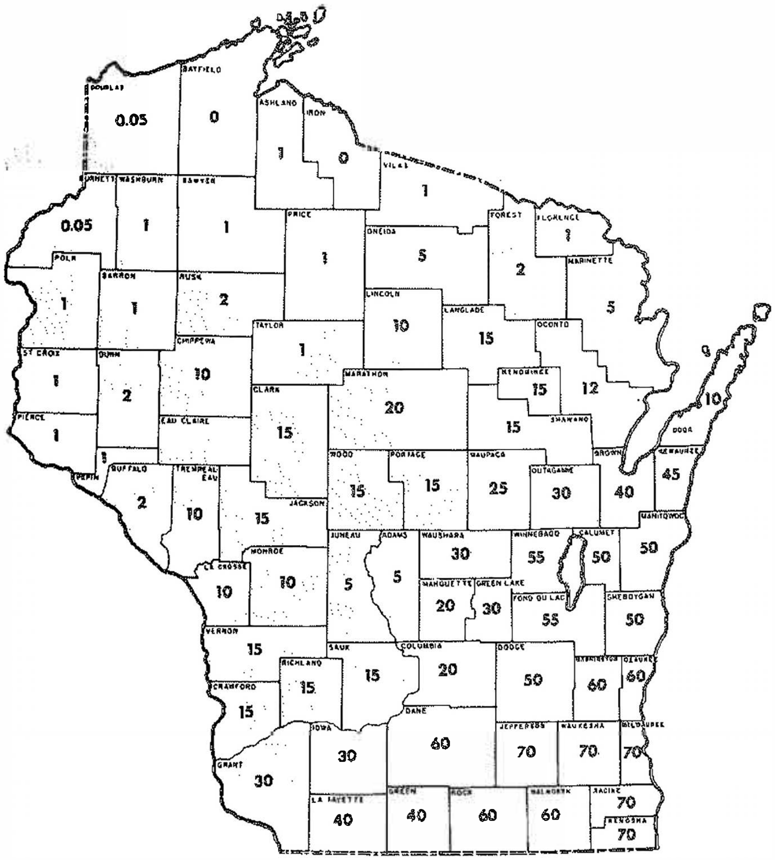

DOUGLAS
0.05
BAYFIELD
0
ASHLAND
1
IRON
0
VILAS
1
BURNETT
WASHBURN
SAWYER
0.05
1
1
PRICE
1
ONEIDA
5
FOREST
2
FLORENCE
1
MARINETTE
5
POLK
1
BARRON
1
RUSK
2
LINCOLN
10
LANGLADE
15
OCONTO
TAYLOR
1
ST CROIX
1
DUNN
2
CHIPPEWA
10
MARATHON
20
MENOMINEE
15
12
SHAWANO
15
DOOR
10
PIERCE
1
EAU CLAIRE
CLARK
15
PEPIN
1
BUFFALO
2
TREMPEALEAU
10
JACKSON
15
WOOD
15
PORTAGE
15
WAUPACA
25
OUTAGAMIE
30
BROWN
40
KEWAUNEE
45
MANITOWOC
50
JUNEAU
5
ADAMS
5
WAUSHARA
30
WINNEBAGO
55
CALUMET
50
MONROE
10
LA CROSSE
10
MARQUETTE
20
GREEN LAKE
30
FOND DU LAC
55
SHEBOYGAN
50
VERNON
15
RICHLAND
15
SAUK
15
COLUMBIA
20
DODGE
50
WASHINGTON
60
OZAUKEE
60
CRAWFORD
15
DANE
60
IOWA
30
JEFFERSON
70
WAUKESHA
70
MILWAUKEE
70
GRANT
30
LA FAYETTE
40
GREEN
40
ROCK
60
WALWORTH
60
RACINE
70
KENOSHA
70

Figure 6. Estimated elm mortality from Dutch elm disease, 1956-1973
(Percent of trees killed).

safe and practical without compromising Dutch elm disease programs, were agreed on by the group and concurred in by the League of Wisconsin Municipalities. They were as follows:

1. Movement of elm logs with bark intact is permissible to any destination within the State of Wisconsin from the period beginning August 1 through April 30 of each year. This stipulation is subject to local government restrictions.

2. Elm logs, brush, and stumps chipped or shredded constitute no hazard to the spread of Dutch elm disease.

3. Diseased elm logs sawed into lumber would be safe for local use or shipment without possibility of spreading D.E.D.

4. Completely debarked logs would be safe at any time for shipment without threat of spreading D.E.D.

5. Stockpiling of elm logs during the months of May, June, and July would not be tolerated.

It was suggested that information on available volume of elm wood in Wisconsin be presented at the Northern Hardwood and Pine Manufacturers Association Meeting at Green Bay in March 1974. An effort to get suppliers and users of elm logs together was discussed.

New Dutch elm disease areas in Menominee County were mapped during three aerial inspection flights in 1973 (Figure 7).

In addition, six areas with serious tree mortality problems in different timber types were photographed from the air. These included critical areas of elm, cedar, hemlock and oak mortality (Figure 8).

The photos were taken from the Department's DC-3 at an altitude of 4,130 feet (Mean Sea Level) on August 20, 1973. The film used was Kodak Aero Ektachrome, Type 2448, which provided a 9" x 9" format and a scale of 1" = 500'. The aerial camera was equipped with an 8¼-inch lens. The photos serve as a base for following, indefinitely, changes that will occur in the timber areas of principal concern.

An accelerated program of salvaging dead and dying timber was recommended to the forester for Menominee Enterprises, Inc.

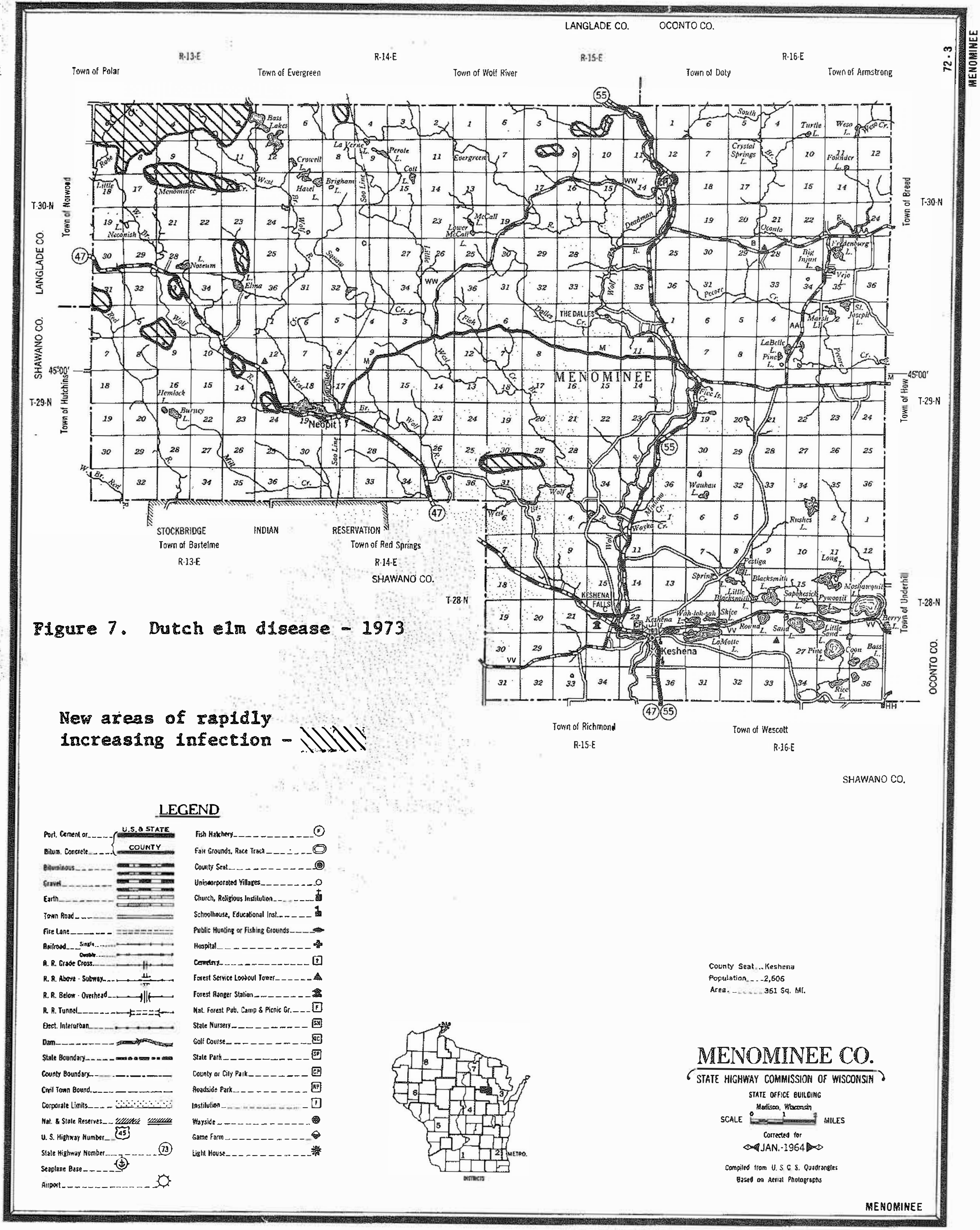

LANGLADE CO.
OCONTO CO.
R-13-E
R-14-E
R-15-E
R-16-E
Town of Polar
Town of Evergreen
Town of Wolf River
Town of Doty
Town of Armstrong
72-3
MENOMINEE
T-30-N
T-29-N
T-28-N
Town of Norwood
Town of Hutchins
LANGLADE CO.
SHAWANO CO.
45°00'
Town of Breed
Town of How
Town of Underhill
OCONTO CO.
MENOMINEE
Neopit
THE DALLES
KESHENA FALLS
Keshena
STOCKBRIDGE
INDIAN
RESERVATION
Town of Bartelme
Town of Red Springs
SHAWANO CO.
Town of Richmond
Town of Wescott
LEGEND
Port. Cement or Bitum. Concrete
U.S. & STATE
COUNTY
Bituminous
Gravel
Earth
Town Road
Fire Lane
Railroad Single Double
R. R. Grade Cross.
R. R. Above - Subway
R. R. Below - Overhead
R. R. Tunnel
Elect. Interurban
Dam
State Boundary
County Boundary
Civil Town Bound.
Corporate Limits
Nat. & State Reserves
U. S. Highway Number
State Highway Number
Seaplane Base
Airport
Fish Hatchery
Fair Grounds, Race Track
County Seat
Unincorporated Villages
Church, Religious Institution
Schoolhouse, Educational Inst.
Public Hunting or Fishing Grounds
Hospital
Cemetery
Forest Service Lookout Tower
Forest Ranger Station
Nat. Forest Pub. Camp & Picnic Gr.
State Nursery
Golf Course
State Park
County or City Park
Roadside Park
Institution
Wayside
Game Farm
Light House
County Seat...Keshena
Population....2,606
Area.........361 Sq. Mi.
MENOMINEE CO.
STATE HIGHWAY COMMISSION OF WISCONSIN
STATE OFFICE BUILDING
Madison, Wisconsin
SCALE MILES
Corrected for JAN.-1964
Compiled from U. S. G. S. Quadrangles
Based on Aerial Photographs
DISTRICTS
METRO.

Figure 7. Dutch elm disease - 1973

New areas of rapidly increasing infection - ▨

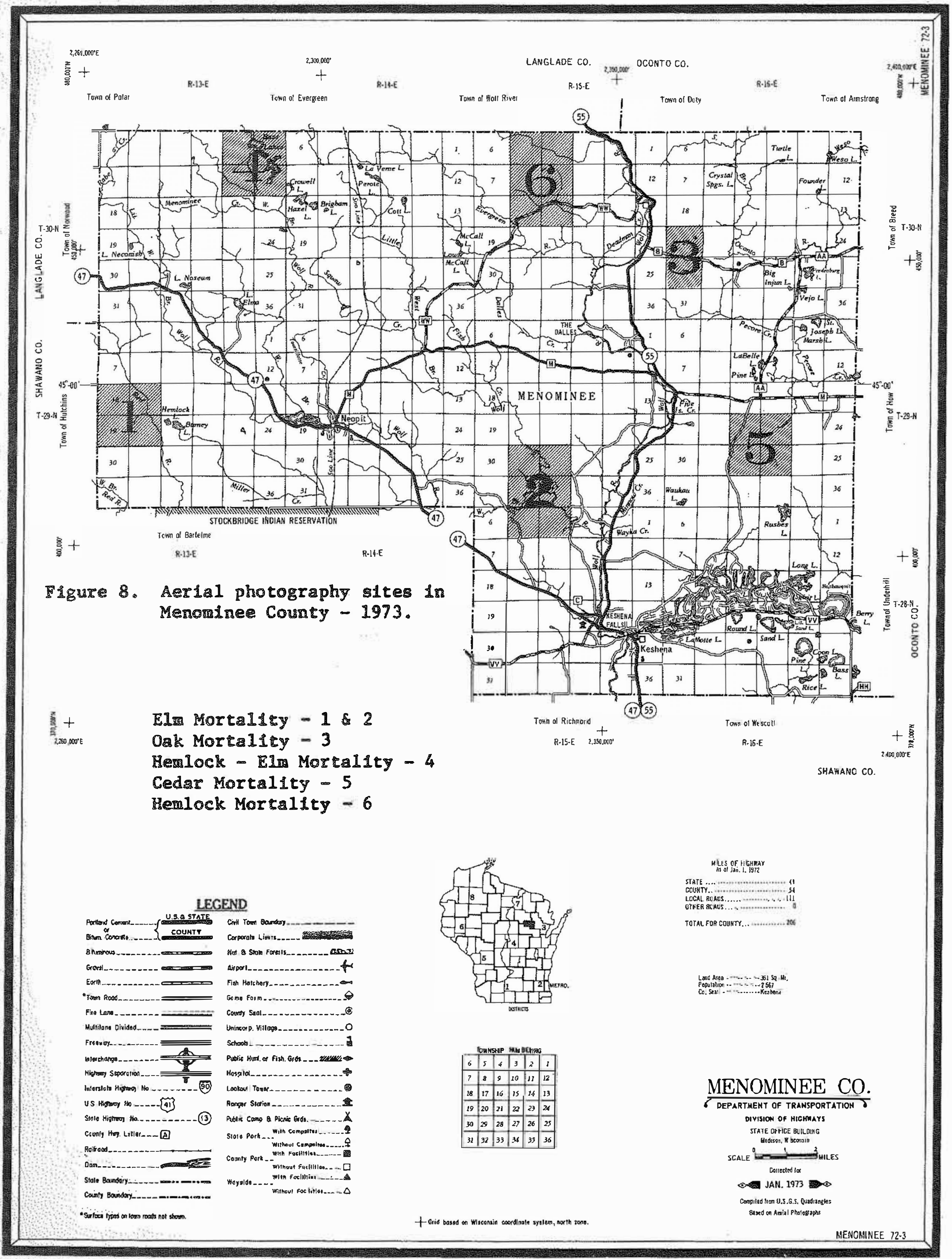
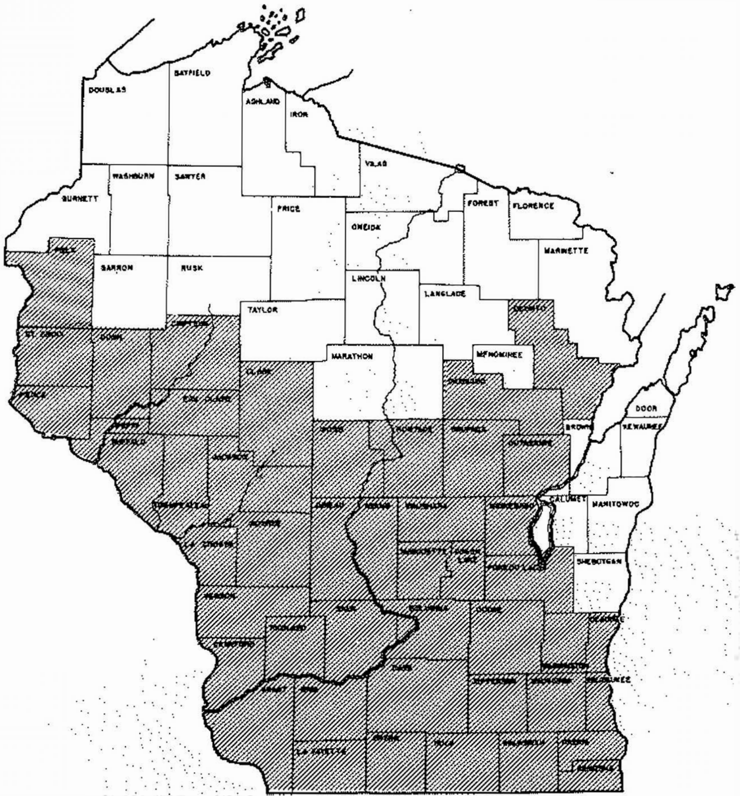

LANGLADE CO.
OCONTO CO.
SHAWANO CO.
LANGLADE CO.
SHAWANO CO.
OCONTO CO.
Town of Polar
Town of Evergreen
Town of Wolf River
Town of Doty
Town of Armstrong
Town of Norwood
Town of Hutchins
Town of Breed
Town of How
Town of Underhill
Town of Bartelme
Town of Richmond
Town of Wescott
R-13-E
R-14-E
R-15-E
R-16-E
T-30-N
T-29-N
T-28-N
45°-00'
MENOMINEE
STOCKBRIDGE INDIAN RESERVATION
Neopit
Keshena
KESHENA FALLS
THE DALLES
1
2
3
4
5
6
LEGEND
MILES OF HIGHWAY as of Jan. 1, 1972
STATE 41
COUNTY 54
LOCAL ROADS 111
OTHER ROADS 0
TOTAL FOR COUNTY 206
Land Area 361 Sq. Mi.
Population 2 567
Co. Seat Keshena
TOWNSHIP NUMBERING
DISTRICTS
METRO.
MENOMINEE CO.
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STATE OFFICE BUILDING
Madison, Wisconsin
SCALE 0 1 2 MILES
Corrected for
JAN. 1973
Compiled from U.S.G.S. Quadrangles
Based on Aerial Photographs
Grid based on Wisconsin coordinate system, north zone.
*Surface types on town roads not shown.
MENOMINEE 72-3

Figure 8. Aerial photography sites in Menominee County - 1973.

Elm Mortality - 1 & 2
Oak Mortality - 3
Hemlock - Elm Mortality - 4
Cedar Mortality - 5
Hemlock Mortality - 6

Oak Wilt - Ceratocystis fagacearum (Bretz) Hunt

There was no change in the statewide distribution of oak wilt in Wisconsin during 1972 and 1973 (Figure 9).


DOUGLAS
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ASHLAND
IRON
VILAS
WASHBURN
SAWYER
BURNETT
PRICE
ONEIDA
FOREST
FLORENCE
MARINETTE
BARRON
RUSK
LINCOLN
LANGLADE
TAYLOR
MARATHON
MENOMINEE
DOOR
KEWAUNEE
CALUMET
MANITOWOC
SHEBOYGAN

Figure 9. Known distribution of oak wilt in Wisconsin - 1973

1973
This disease continues to kill oaks in southern and central Wisconsin. An unusual number of white and bur oaks were infected and died this year.

Butternut Dieback - Melanconis juglandis (E. & E.) Graves

1973
Butternut mortality and dieback continues to be a problem in southwestern Wisconsin. Studies are in progress at the University of Wisconsin on the fungi associated with the dieback.

ROOT ROTS

Shoestring Root Rot - Armillaria mellea (Vahl ex Fr.) Kummer

1972
Armillaria root rot is associated with red pine mortality at several sites from the central counties northward, and especially where herbicides have been used to release the pine from oak overstory within the last seven or

eight years (1971 Annual Report). The fungus was also observed on a windthrown Scotch pine and a windthrown red pine in the Star Lake plantation in Vilas County. It was also associated with jack-pine-mortality in northern Adams County, in plantations more than 20 years old which are also plagued with a variety of insect problems.

Mortality was 33% in an A. mellea study plot in Marinette County (NW¼, SW¼, Section 31, T33N, R19E) in 1972. This plot established by forest pathologists at the University of Wisconsin had 24% mortality the previous year. In other plots of similar age and treatment mortality was 8.5% on the Brule River State Forest and 9.5% in the Jackson County Forest (Section 13, T21N, R1W).

1973

The development and impact of Armillaria mellea is being studied by R. F. Patton and John Pronos, Department of Plant Pathology, University of Wisconsin-Madison. The study is in red and jack pine plantations established on old hardwood sites, or under low-value hardwoods which were killed by herbicides or hand-girdling. Annual mortality records showed increases of 2, 10, and 2 percent on sample plots in Douglas, Jackson, and Marinette counties, bringing the total tree losses in these respective areas to 10, 17, and 36 percent. The rate of annual mortality seemed to be leveling off in two 9-year-old plantations (Douglas and Marinette counties), but was still increasing in a 7-year-old plantation (Jackson County).

An aerial photograph survey of Armillaria mellea was conducted on four of the sites in Jackson County (Figure 10). The areas were photographed on October 4, 1973 with 70-mm Kodak Aero Ektachrome, Type 2448 at scales of 1:2,000 (1' = 167') and 1:10,000 (1' = 833'). A Hassleblad camera with a 60 mm flocal-length lens was mounted in a DNR Beech T-34 that had a plate glass porthole in the floor of the fuselage. Disease incidence on the ground will be compared with disease incidence on the aerial photographs.

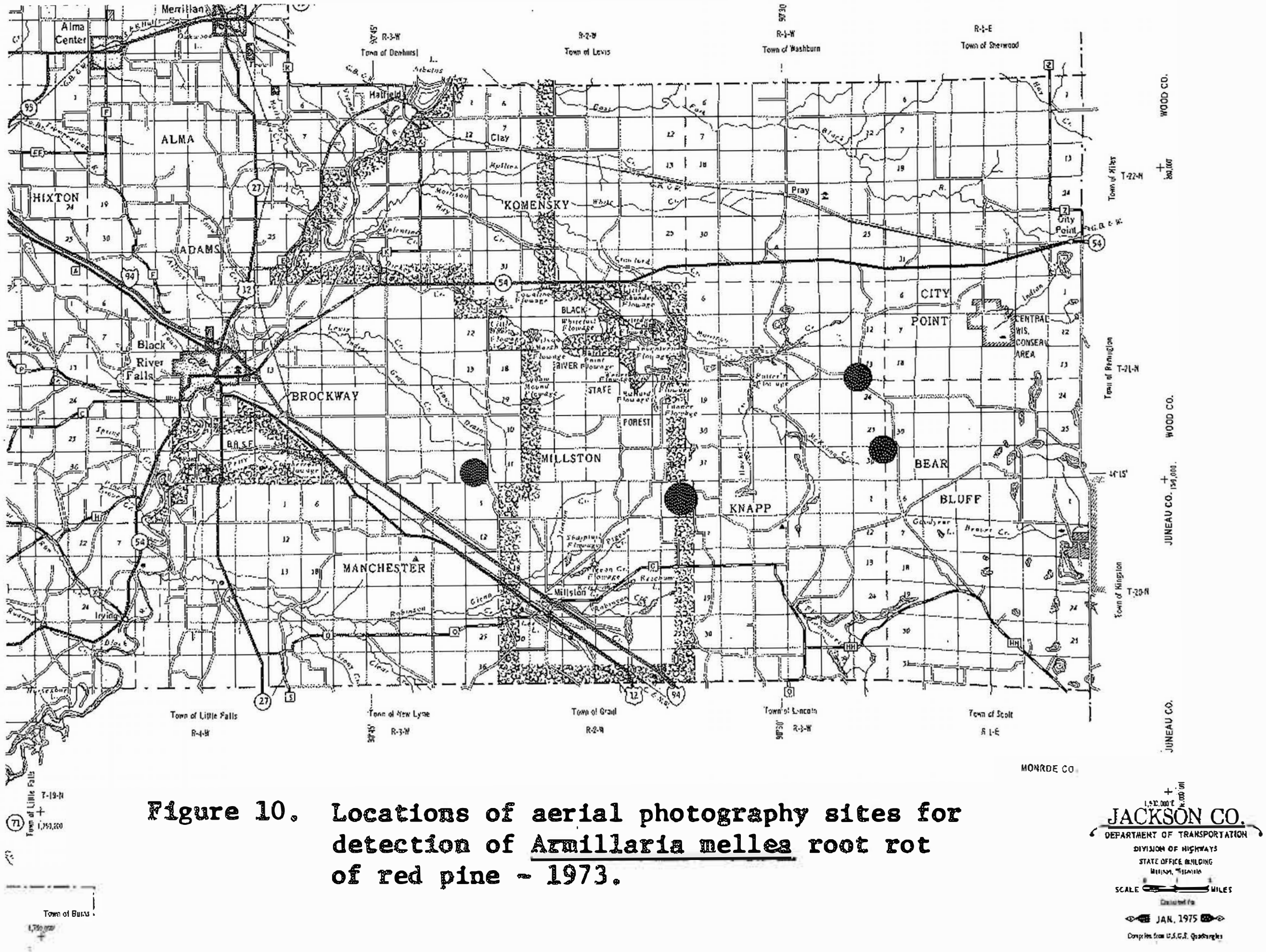

Figure 10. Locations of aerial photography sites for detection of Armillaria mellea root rot of red pine - 1973.

Tomentosus Root Rot - Polyporus tomentosus Fr.

1972

Polyporus tomentosus was collected from a basal wound on a red pine in a plantation established in 1912 in Washburn County (NW¼, NW¼, Section 3, T42N, R12W). There was no dieback or mortality noted in this plantation composed of red, white and Scotch pine.

Cylindrocladium Root Rot - Cylindrocladium scoparium Morgan

1973

Cylindrocladium root rot still appears to be causing problems in Wisconsin's forest tree nurseries. Pines and spruces are affected at all nurseries. The fungus may also be infecting hardwood shrubs at Boscobel Nursery. Studies on the control of cylindrocladium are in progress at the University of Wisconsin.

FOLIAGE DISEASES

Brown Spot Needle Blight - Lecanosticta acicola (Thuem.) Syd.

1972

Brown spot has been reported in a total of 18 counties since 1966 (Figure 11). No new county locations were noted in 1972.

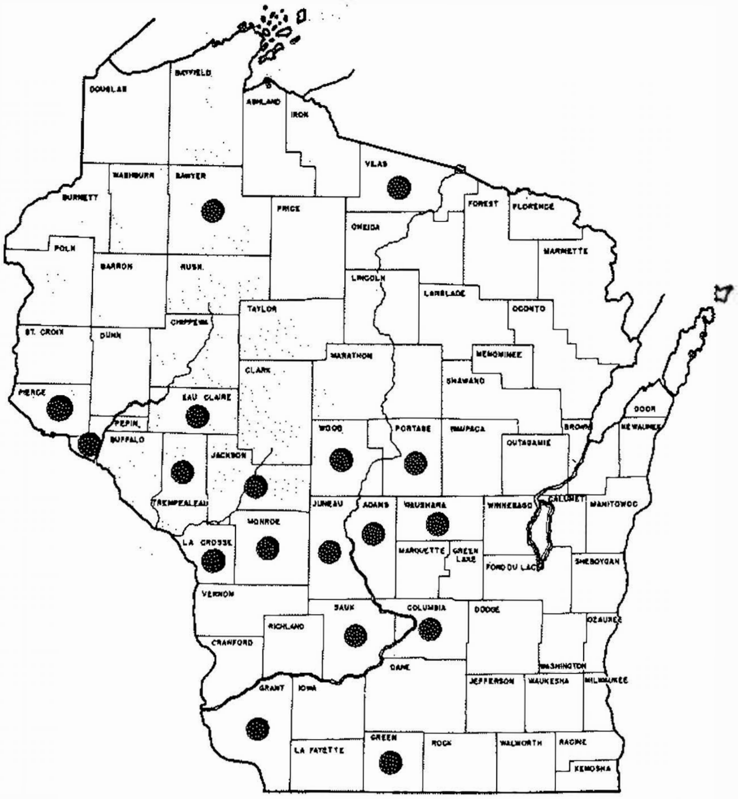
DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
WASHBURN
SAWYER
BURNETT
PRICE
ONEIDA
FOREST
FLORENCE
MARINETTE
POLK
BARRON
RUSK
LINCOLN
LANGLADE
OCONTO
TAYLOR
ST. CROIX
DUNN
CHIPPEWA
MARATHON
MENOMINEE
SHAWANO
CLARK
PIERCE
EAU CLAIRE
DOOR
PEPIN
BUFFALO
WOOD
PORTAGE
WAUPACA
BROWN
KEWAUNEE
OUTAGAMIE
JACKSON
TREMPEALEAU
JUNEAU
ADAMS
WAUSHARA
WINNEBAGO
CALUMET
MANITOWOC
MONROE
LA CROSSE
MARQUETTE
GREEN LAKE
FOND DU LAC
SHEBOYGAN
VERNON
SAUK
COLUMBIA
DODGE
OZAUKEE
RICHLAND
CRAWFORD
WASHINGTON
DANE
GRANT
IOWA
JEFFERSON
WAUKESHA
MILWAUKEE
GREEN
ROCK
WALWORTH
RACINE
LA FAYETTE
KENOSHA

Figure 11. Known county distribution of brown spot disease of Scotch pine in Wisconsin - 1972.

Brown spot was isolated from 12-15-year-old red pine growing among infected Scotch pine in Jackson County (SW¼, Section 29, T24N, R5W) on October 3, 1972 by Tom Nicholls of the North Central Forest Experiment Station, St. Paul, Minnesota. Brown spot has also been reported on red pine in Grant and Green counties (Forest Pest Conditions in Wisconsin, 1971 Annual Report). In all areas the infection was confined to the previous year's needles and was light. Acervuli bearing conidia were observed on red pine needles in Green County on November 3, 1972.

Northern Christmas Trees, Merrilan, Wisconsin continued to successfully control brown spot in 1972 on approximately 500 acres with 8-8-100 Bordeaux mixture in Jackson and Juneau counties. The Northern Christmas Tree plantations were also treated in 1971 and their locations are listed in the 1971 Annual Report. The disease continued to intensify in untreated Scotch pine plantations in these same counties.

G. R. Kirk Company, Wautoma treated 604 acres in 1971 with Bordeaux mixture but did not have to spray in 1972 because many of the trees were harvested in 1971. Also, spraying in 1971 prevented new infections on the remaining trees.

1973

There was no major increase in brown spot disease on Scotch pine in 1973. Most Christmas tree growers have controlled the disease in previous years with fungicide sprays.

The disease was reported on red pine in Grant and Green counties in 1972 and in Jackson County in 1973. In all areas the infection has been confined to the previous year's needles and was light.

Lophodermium Needle Cast - Lophodermium pinastri (Schrad.) Chev.

1972

Lophodermium needle cast, a problem on Scotch pine Christmas trees in 11 northeastern states has not been a problem in Wisconsin. However, Lophodermium pinastri was isolated on October 3, 1972 from 1971 needles of a Spanish variety Scotch pine in a Jackson County Christmas tree plantation (Section 29, T24N, R5W). The plantation was treated for the control of brown spot with Bordeaux mixture in 1972 but not for Lophodermium needle cast. Lophodermium pinastri was also isolated from Spey Valley Scotch pine seedlings that were received from Clarino Nurseries, Indiana, Pennsylvania and planted by a Christmas tree grower in Rock County (N½, Section 21, T1N, R10E).

Lophodermium pinastri and Naemycyclus niveus were collected from a Scotch pine Christmas tree plantation in Portage County (SW¼, Section 16, T21N, R10E on August 30, 1972.

Lophodermium needle cast of red pine was controlled with Maneb sprays at the Hugo Sauer Nursery at Rhinelander. But the disease continues to occur in unsprayed check plots indicating spores are present in the nursery.

1973

Lophodermium needle cast was found on approximately 1,200 acres of Scotch pine Christmas tree plantations in Central Wisconsin. The majority of infected trees occurred in Waushara and Portage counties with Spanish and French varieties of Scotch pine most severely affected.

Symptoms were first observed in March and were difficult to distinguish from winter injury. However, isolations revealed that Lophodermium pinastri was present on 1,200 acres. One Christmas tree grower planned to treat approximately 4,000 acres, however, surveys indicated that only 600 acres needed to be treated. In 1973 Wisconsin Christmas tree growers sprayed a total of 687 acres of Scotch pine twice with maneb (Table 1).

Lophodermium pinastri was again found in out-of-state nursery stock. A Christmas tree grower in southern Wisconsin received a shipment of Scotch pine nursery stock from Clarino Nurseries, Indiana, Pennsylvania. He planted the seedlings next to some high-quality 5- to 7-year-old Scotch pine Christmas trees in Rock County (N½ Section 21, T1N, R10E). The seedlings turned brown in May and Lophodermium fruiting bodies developed on the dead needles in August. The grower finally destroyed the trees to prevent the disease from spreading to the adjacent healthy trees that were soon to be harvested for Christmas trees. In 1973 the same grower ordered more Scotch pine seedlings, but from a different Pennsylvania nursery (C and E Nursery, Indiana, Pennsylvania). When the stock arrived in Wisconsin the needles were already brown. Isolations from the needles revealed that the trees were heavily infected with Lophodermium. This time he did not plant the stock, but destroyed it so it wouldn't pose a threat to his healthy plantation trees.

Lophodermium needle cast was prevented on red pine seedlings in 1973 with Maneb sprays applied in 1972 at Hugo Sauer Nursery at Rhinelander. Experimental control plots established by the North Central Forest Experiment Station showed infection was 96% in 1973 in unsprayed plots. This compares with 40% infection in unsprayed plots in 1972. No Lophodermium was found on red pine seedlings in 1973 that were sprayed four times (August 1, 15, September 1, 15) with Maneb in 1972.

Table 1. Scotch Pine Christmas Tree Plantations Treated for Lophodermium pinastri with Maneb in Wisconsin in 1973.

County	Location	Acres	Equipment
Jackson	NE¼, Sec. 29,T24N,R5W	60	Mistblower
	Sec. 24,T24N,R6W	20	Mistblower
	NW¼, Sec. 22, T24N, R6W	5	Mistblower
Langlade	NE, NW, Sec. ,T30N, R11E	2	Aerial Applicator
Portage	Sec. 24, T21N, R9E	35	Aerial & mistblower
	Sec. 16, T21N, R10E	65	Mistblower
	Sec. 35, T22N, R9E	50	Mistblower
Waushara	Sec. 11, T18N, R9E	100	Mistblower
	Sec. 17 & 18, T18N, R9E	100	Mistblower
	Sec. 35, T18N, R9E	15	Mistblower
	Sec. 9, T18N, R10E	100	Mistblower
	Sec. 36, T19N, R9E	45	Mistblower
	Sec. 35, T20N, R8E	50	Mistblower
	Sec. 5, T20N, R9E	40	Aerial
TOTAL		600	

Jack Pine Needle Cast - Davisomycella (Hypodermella) ampla

1973

Davisomycella ampla was common in most jack pine stands in southern and central Wisconsin this spring. The previous year's needles were cast in May leaving only the current season's growth.

Spruce Needle Cast Rhizosphaera kalkhoffii Bub.

1972

Rhizosphaera kalkhoffii continued to defoliate Colorado Blue spruce Christmas tree plantations in Wisconsin. Previously unreported locations of R. kalkhoffii in Wisconsin are listed in Table 2.

Forest pathologists from the North Central Forest Experiment Station, U. S. Department of Agriculture, Forest Service, St. Paul, Minnesota established experimental control plots in a blue spruce Christmas plantation in Jackson County, Wisconsin and near Hastings, Minnesota. Several fungicides and spray schedules were tried. The results of these trials should be available in 1973.

1973

Rhizosphaera kalkhoffii continues to damage Colorado blue spruce Christmas trees and windbreak trees in Wisconsin. A survey of Wisconsin nurseries by the Wisconsin Department of Agriculture in 1973 showed that R. kalkhoffii was the most prevalent disease of blue spruce nursery stock. The fungus was not found on Black Hills, white or Norway spruce nursery stock.

North Central Forest Experiment Station Plant Pathologists continued to evaluate R. kalkhoffii life cycle and control plots in Jackson and Waushara counties in 1973. The most effective fungicides tested were benomyl, Daconil and Bordeaux mixture. Benomyl and Daconil are not registered for Rhizosphaera control but Bordeaux misture is registered for needle cast on spruce.

Table 2. Collections of Rhizosphaera kalkhoffii in Wisconsin in 1972.

County	Location	Date	Host
Clark Co.	Sec. 10 & 15 T24N, R4W	6/9/72	10,000 Blue Spruce Christmas trees
Douglas Co.	Pattison Ranger Station	9/28/72	Ornamental blue spruce
Douglas Co.	SW, NW, Sec. 25 T45N, R13W	9/28/72	Blue spruce windbreak
Jackson	NE, NE, Sec. 11 T24N, R6W	5/2/72	2,000 White spruce Christmas trees
Oneida	Hugo Sauer Nursery Rhinelander	5/23/72	Blue spruce windbreak
Portage	Govt. Lot #20, Sec. 30 T21N, R9E	10/19/72	4,000 Blue spruce Christmas trees
Vilas	Sec. 32, T42N, R7E	8/3/72	Black spruce
Vilas	SW, SW, Sec. 16 T41N, R8E	7/21/72	Black spruce
Waushara	NE¼, Sec. 21 T19N, R10E	6/7/72	Ornamental blue spruce
Waushara	NE, SW, Sec. 1 T19N, R10E		10,000 Blue spruce Christmas trees

White Pine Needle Blight - Atmospheric Gases

1972

White pine needles are sensitive indicators of the presence of relatively low concentrations of sulfur dioxide and ozone in the atmosphere. Either of these gases causes a characteristic reddish-brown discoloration of the needle tips which is known as tip-burn or white pine needle blight.

White pine needle blight continued to occur on approximately 10% of the white pine Christmas trees in Green and Rock counties in 1972 but was not reported in other counties.

Fifty verified air-pollution-susceptible and fifty verified air-pollution-resistant grated white pine selections, provided by the University of Wisconsin, were planted at the U. S. Forest Service Oconto River Seed Orchard near Langlade, Wisconsin.

1973

White pine needle blight was conspicuous in the Northern Highland State Forest in Vilas and Iron counties. It was first observed on August 10 and the same trees are affected to the same degree as in 1970. Air-pollution-susceptible trees planted at the Oconto River Seed Orchard near Antigo (Langlade County) were not affected.

Air Pollution

1972

The Forest Pest Control Section cooperated with the DNR Air Pollution Control Section in a survey for air pollution damage to vegetation in the vicinity of Wisconsin's major point sources of air pollution. The survey conducted in July and August did not involve detailed plot studies but was a preliminary survey to determine if acute injury to vegetation was occurring in the area. Areas investigated include Alma, Kaukauna, Oconto Falls, Green Bay, Beloit-Janesville, Nekoosa-Port Edwards, Cassville, Wausau and the Lake Michigan shoreline in Racine and Kenosha counties.

The DNR Air Pollution Control Section received a complaint from the Village of Brokaw in Marathon County on July 16, 1972 of fume damage to vegetation. The DNR Forest Pathologist, an Air Pollution Control Engineer and Biologist examined the area on August 2, 1972. Acute sulfur dioxide injury in the form of necrotic spots and interveinal necrosis was observed on clematis, roses, peonies, hydrangea, blue spruce, white pine, red pine, sugar maple, silver maple, flowering crab, boxelder, lilac, honeysuckle, kohlrabi, cabbage and tomato. All the damage occurred within 1000' of the Wausau Paper Mill. It appears the injury was caused by sulfuric acid mist coming from the acid towers located at Wausau Paper Company Mill at Brokaw. The towers are an integral part of the Copeland Recovery System operated at the mill. The DNR Air Pollution Control Section has planned to monitor ambient levels of sulfur oxides and record meteorological conditions in Brokaw in 1973.

Mercury levels in trees growing near Port Edwards, Wisconsin were sampled by Ronald Becker, DNR Air Pollution Control Specialist and Allen Prey, DNR Forest Pathologist (Appendix B).

1973

The Forest Pest Control Section again cooperated with the DNR Air Pollution Control Section in surveying air pollution injury to vegetation in Wisconsin. An equipment failure on the night of August 2 at St. Regis Paper Company in Rhinelander resulted in the ground level release of high concentrations of SO_2 for approximately one-half hour. The pollutants drifted southward. Characteristic SO_2 injury to a variety of vegetation was obvious in an area approximately one-eighth mile wide and one-half mile long south of the plant. The injury has been mapped by forest pest survey personnel at Antigo. The severity of the injury could not be adequately assessed until the next growing season.

A monitoring device for sulfur oxides was in operation at Brokaw in the late summer of 1973. Vegetation injury in 1972 indicated a need for the air monitoring study as well as continued surveillance of vegetation in the village. Injury occurred again in August 1973 and was mapped. Orders will be issued requiring control of sulfur emissions from the mill.

An air pollution specialist with the Bureau of Air Pollution Control made three visits to Alma, Wisconsin in 1973. On June 5 no air pollution related vegetation injury was observed. On June 23 a white birch sapling at Buena Vista Park exhibited symptoms typical of injury caused by sulfur dioxide. The September 12 visit revealed partial and complete defoliation of some trees at Buena Vista Park. Some trees were producing new leaves. The canopy of leaves on the southern slope of the park appeared very thin although seasonal leaf changes complicated the observations. The cause of this condition could not be definitely determined although fumigation with stack gases from the Alma Generating Station could produce such symptoms. Operation of a new 700 foot smokestack will begin in 1974 and should reduce ground level concentrations of SO_2 in the immediate area.

STEM AND BRANCH DISEASES

Aspen Shoot Blight - Pollaccia radiosa (Lib.) Bald. & Cif.

1972

Aspen sprouts were damaged at several sites by this disease. In a single 100-acre area in Langlade County (NW¼, Section 4, T32N, R12E) 75% of the sprout tips were damaged.

1973

Shoot blight and leaf spot was prevalent in most aspen stands in Wisconsin. Many trees acquired a bronze color by late August and the leaves fell prematurely. Shoot blight appears to be a major cause of forking in young aspen stands. For example, a survey of injury to young trembling aspen stems in Langlade County showed that Venturia spp. was the major cause of topkill. However, cankers of unknown origin were the most prevalent problem (Appendix D).

Balsam Fir Canker - Aleurodiscus amorphus (Pers.) Rabenh.

1972

Numerous dead and dying balsam fir of all sizes, in a stand consisting largely of suppressed saplings and pole-size trees growing under an overstory of maple and birch, were found in NE¼, SW¼, Section 8, T35N, R10E (Oneida County). Only a few trees in the 2" - 4" dbh class had definite cankers. Large balsam, over 4" dbh, were dead from unknown causes. Ten cankered trees ranging from 2 - 4" dbh were tagged on June 12, 1972 and were observed again on October 12, 1972. None of the tagged trees were killed and the cankers did not enlarge. This plot will be examined again next year.

1973

Aleurodiscus canker plots established in 1972 in Oneida County were examined in 1973. There was no increase in the number of cankers or in the size of existing cankers, indicating the cankers were all initiated in a single year.

Cylindrocladium Canker of White Pine Nursery Stock - *Cylindrocladium scoparium* Morgan

1972

The fungus, *Cylindrocladium scoparium*, has caused cankers and is killing 3-0 white pine seedlings at Griffith Nursery (Wood County), more than 200,000 seedlings were affected (Figure 12). Apparently, excessive rainfall in July and August, and subsequent continued wet weather provided favorable suitable conditions for an epidemic of the disease. White pine seedlings and transplants are similarly affected, but to a lesser degree, at Boscobel (Grant County) and Hayward (Sawyer County) nurseries. Studies are in progress at the University of Wisconsin to develop a control for Cylindrocladium canker.

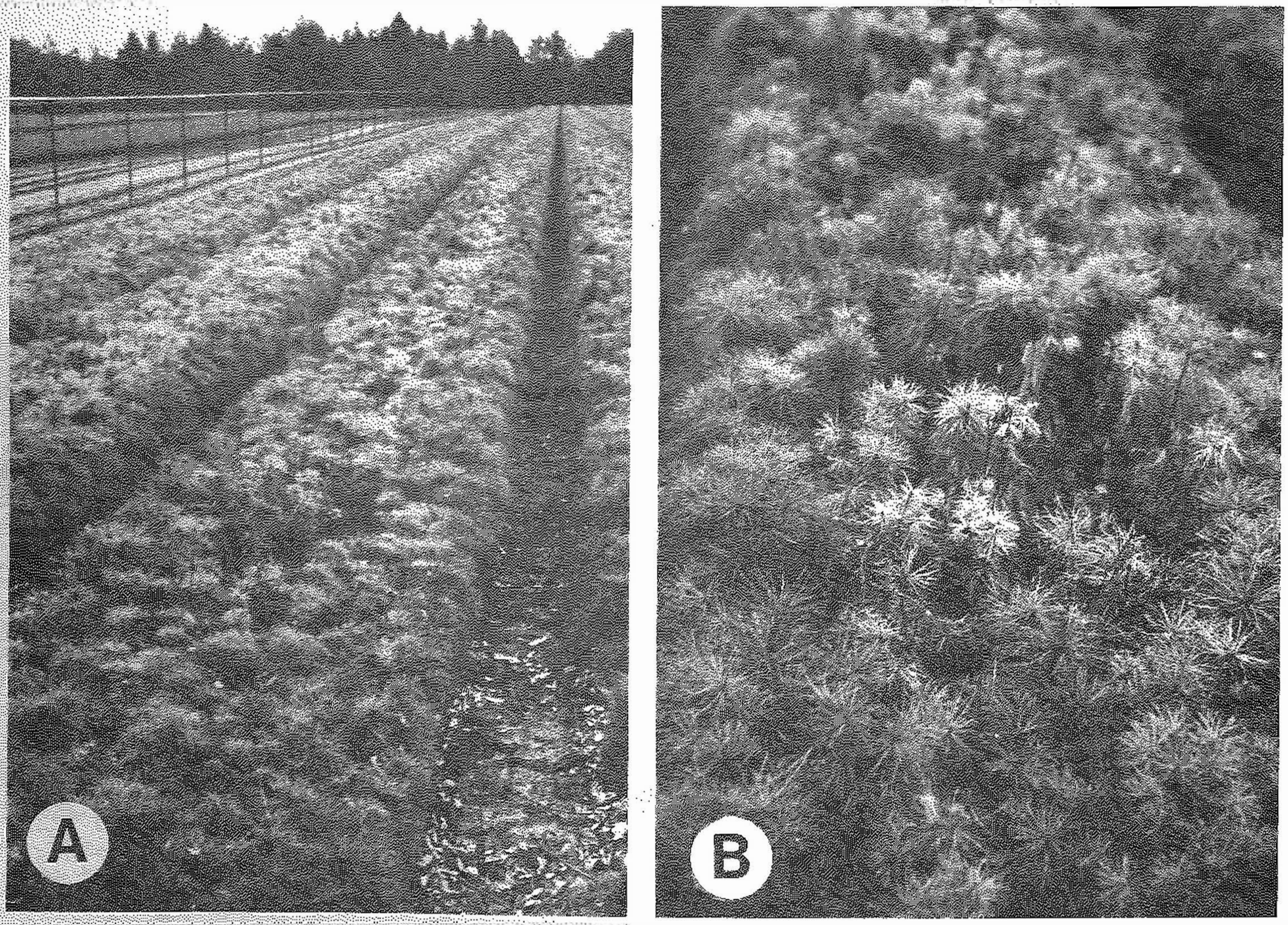

Figure 12. Cylindrocladium canker at Griffith State Forest Nursery, Wis. Rapids, Wis. (Nov. 9, 1972). A. Infected 3-0 white pine. B. White pine seedling mortality within a seedbed.

Dwarf Mistletoe - Arceuthobium pusillum Pk.

1972
A 30-acre black spruce stand in Langlade County (Section 34, T32N, R9E) was heavily infected and contained many witches brooms.

Red Pine Shoot Blight - Sirococcus strobilinus Preuss

1972
This disease is characterized by premature dying of lower branches on infected trees and the current year's shoots may be killed. Not all shoots on a tree are attacked in a single year but damage to new growth on red pine reproduction in close proximity to infected pole and sawlog-size trees is especially severe (Figure 13). The fungus Sirococcus strobilinus Preuss has been identified as the causal agent by James T. O'Brien, Plant Pathologist, Northeastern Area, State and Private Forestry, Forest Service, U.S.D.A., St. Paul, Minnesota.

Shoot blight was observed on more than 280 acres of state, county and Indian reservation land (Table 3). Known locations of shoot blight in Vilas County were mapped (Figure 14). These commonly occurred as small areas of infected trees, particularly near Conover where individual sawlog trees and scattered infected reproduction nearby were frequently noted. Permanent plots were established at two locations in Vilas County to determine the impact of the disease on planted and natural reproduction growing in a variety of situations (Appendix A).

Surveys by the DNR in northwestern Wisconsin have not revealed the presence of the disease in plantations or natural red pine stands, although it has been reported on 5,000 - 8,000 acres of Nicolet Forest land in Vilas, Florence and Forest counties. A more intensive survey is planned for 1973 on non-federal lands in Wisconsin.

Table 3. Red Pine Shoot Blight in Vilas County, 1972 DNR Survey.

Location		Acreage Affected
Northern Highland State Forest		
Starrett Lake Area	T41N, R7E, Sec. 24	150
Stella Creek Area	T41N, R8E, Sec. 26, NE SE	20
Vilas County Forest		
Heart Lake	T42N, R10E, Sec. 32, SE SW	20
Marshall Lake	T42N, R9E, Sec. 27, NW NW	10
Private		
Uihlein Plantation	T42N, R9E, Sec. 24, NW NW	30
Walter Mayo	T40N, R11E, Sec. 11, NW¼	10
Lac du Flambeau Indian Reservation		
Mishonagon Swamp Area	T40N, R6E, Sec. 29, NW SE	40
Total		280

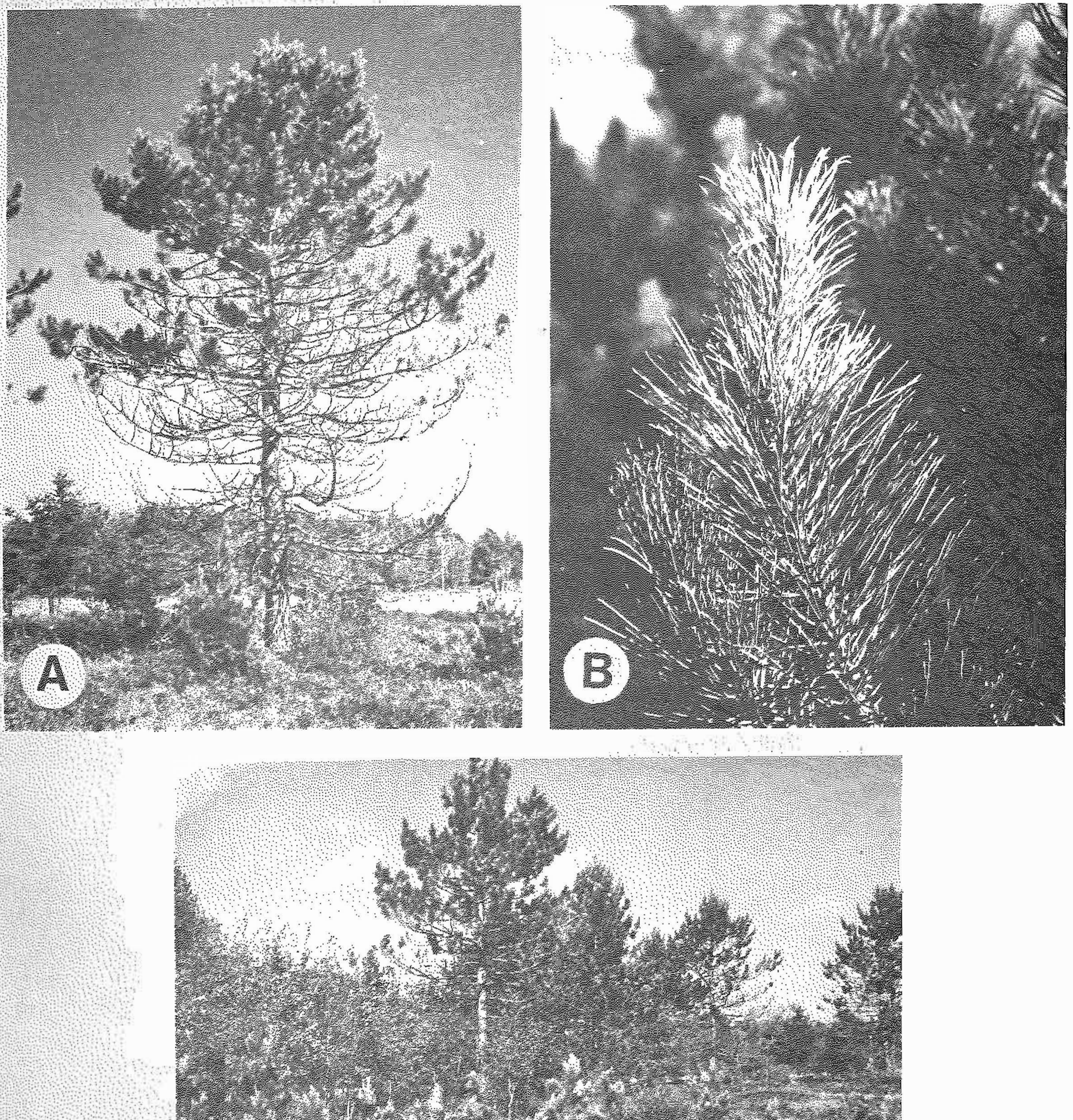

Figure 13. Red pine blight (*Sirococcus strobilinus* Preuss) in Vilas County, September 21, 1972. A. Lower branches of infected trees die prematurely. B. Current year shoots are killed. C. Damage to current years shoots on reproduction adjacent to infected pole-and sawlog-size trees.

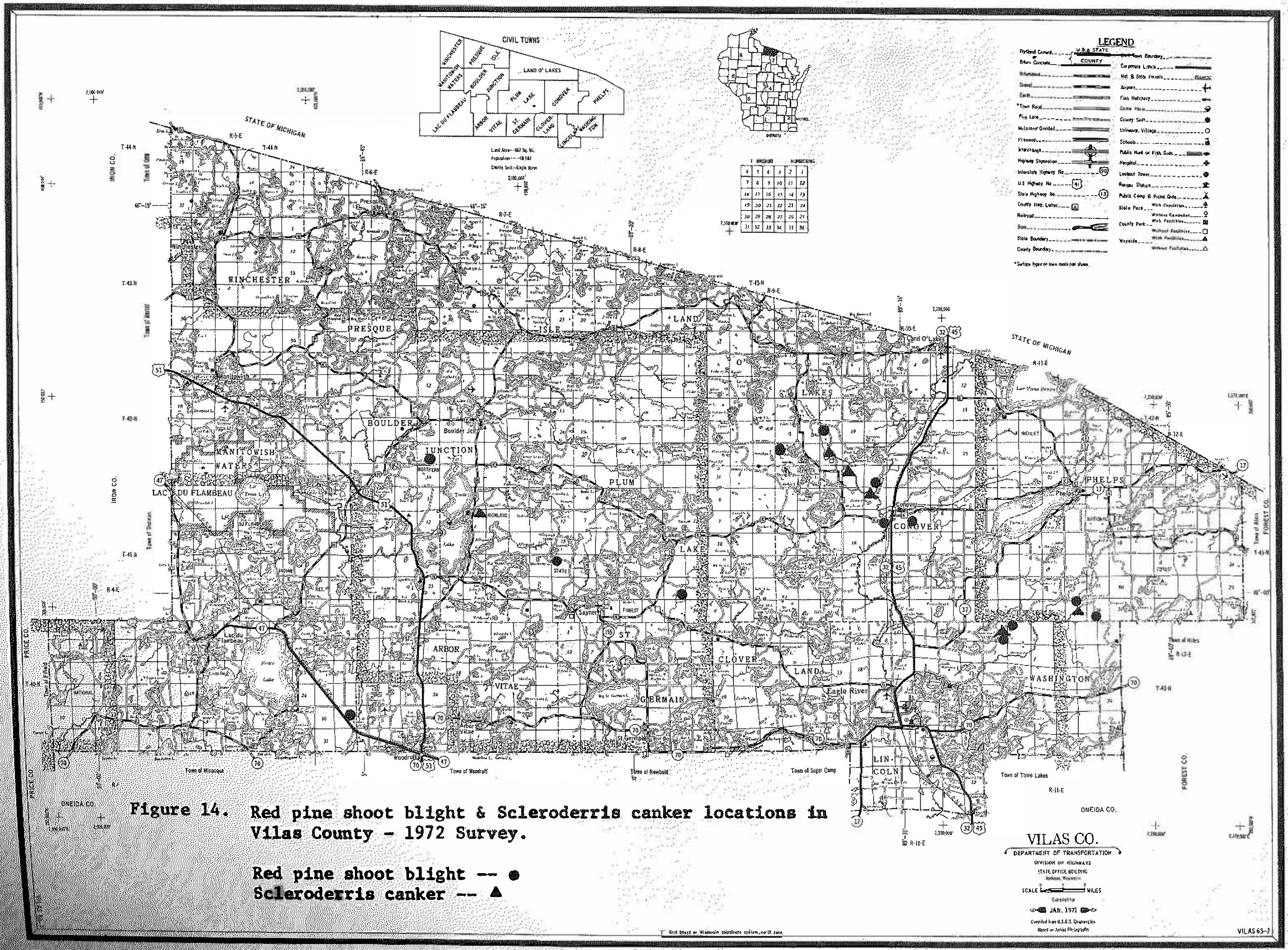
CIVIL TOWNS
WINCHESTER
PRESQUE ISLE
LAND O' LAKES
MANITOWISH WATERS
BOULDER JUNCTION
PLUM LAKE
CONOVER
PHELPS
LAC DU FLAMBEAU
ARBOR VITAE
ST. GERMAIN
CLOVERLAND
LINCOLN
WASHINGTON
STATE OF MICHIGAN
IRON CO.
PRICE CO.
ONEIDA CO.
FOREST CO.
LEGEND
Eagle River
Woodruff
Sayner
Phelps
Conover
Land O'Lakes
Presque Isle
Boulder Jct.
Manitowish Waters
Lac du Flambeau
Arbor Vitae
St. Germain
VILAS CO.
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STATE OFFICE BUILDING
SCALE MILES
JAN. 1971
VILAS 63-7

Figure 14. Red pine shoot blight & Scleroderris canker locations in Vilas County - 1972 Survey.

Red pine shoot blight -- ●

Scleroderris canker -- ▲

1973

Shoot blight was reported for the first time in Bayfield and Oneida counties. There was a noticeable increase in the number of young red pine areas affected in central and eastern Vilas County. Red pine in many of the same areas were also affected by Scleroderris canker and Saratoga spittlebug. This was complicated data taking on shoot blight plots established in 1972. One impact plot, where shoot blight apparently is the only problem, showed an increase of tree mortality from 10 to 16 percent. Trees killed were suppressed or non-crop within 50 feet of pole-size red pine showing shoot blight symptoms in the lower crown. Reproduction growing in the openings showed a moderate increase of new shoot infections during 1973. However, the percent of total shoots affected dropped from 21 to 15 percent.

The Wisconsin DNR cooperated with the North Central Forest Experiment Station in an ecological study of red pine shoot blight on the Northern Highland State Forest in Vilas County. Similar study areas were also established on the Eagle River District of the Nicolet National Forest and on the Isabella District of the Superior National Forest in Minnesota. Spore trapping, phenological data, and weather data was collected from April 23 - October 22, 1973. The results from the Northern Highland State Forest study plot showed major Sirococcus spore discharge between May 21 and June 4, 1973 (Figure 15).

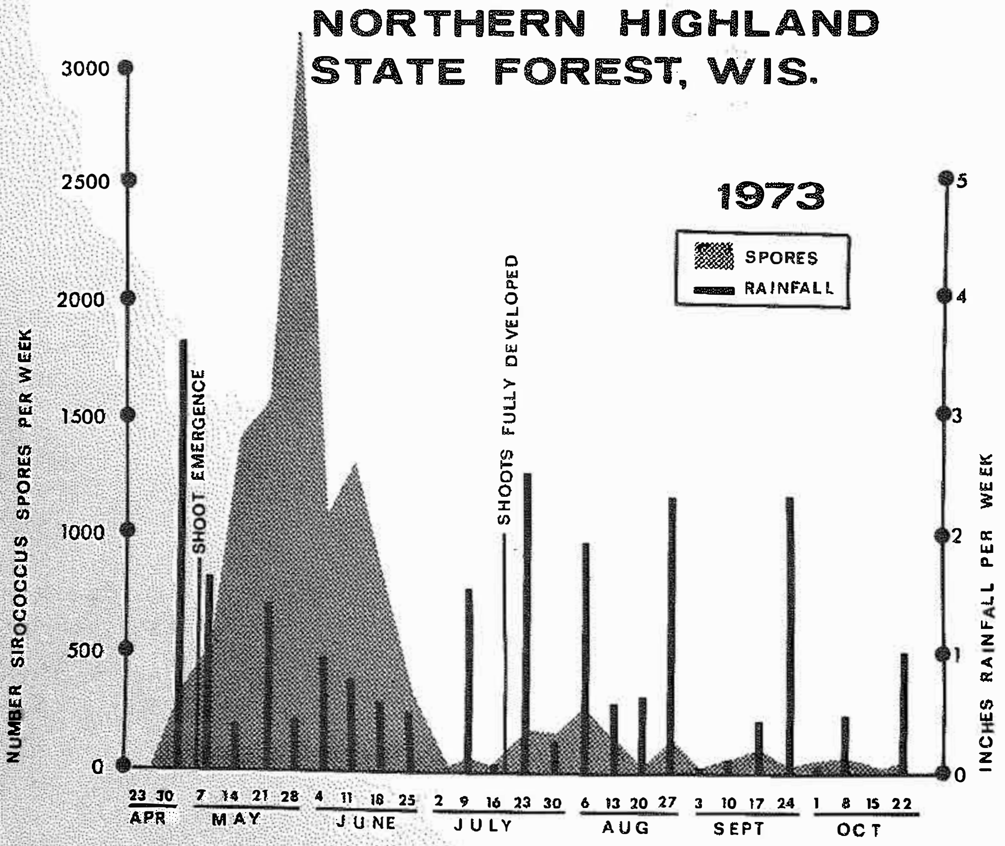

Figure 15. Weekly spore release, rainfall and shoot development in red pine shoot blight study area, Northern Highland State Forest, 1973. (Courtesy of USDA, Forest Service, North Central Forest Expt. Sta.).

Scleroderris Canker - Scleroderris lagerbergii Gremmen

1972

Scleroderris canker was observed in some red pine plantations in Vilas County where red pine shoot blight was also present (Figure 14). Cankers were on trees less than 10 feet tall and were confined to the lower branches. It appeared that most of the infections were below the snowline.

In order to evaluate the progress of S. lagerbergii in specific plantations, plots were established during 1971 at three locations in Vilas County (Forest Pest Conditions in Wisconsin, 1971 Annual Report). An examination of these tagged trees in 1972 shows the following comparison (Table 4).

Table 4. Red Pine Twigs and Whorls Killed by Scleroderris lagerbergii

Location	Trees	Average Tree Height	Twigs Killed 1971	Twigs Killed 1972	Whorls Killed 1971	Whorls Killed 1972
	(No.)	(Ft.)	(No.)	(No.)	(No.)	(No.)
Sec. 24, T42N R9E	12	8	241	221	4	2
Sec. 32, T42N R10E	8	5	167	254	2	2
Sec. 31, T42N R10E	8	10	75	79	1	2
Total	28	--	483	554	7	6

These plots will be read again in future years in order to follow the progress of twig and branch mortality. It appears unlikely that serious mortality will occur in trees over five feet tall on these sites. The problem may be aggravated, however, where the same plantations are often affected by other problems such as shoot blight in the higher crown, frost damage, white pine weevil and Armillaria root rot.

1973

There was an increase of Scleroderris canker in young red pine plantations in eastern Vilas County. Symptoms were frequently observed in the same plantations affected by red pine shoot blight and old Saratoga spittle bug damage. Branch mortality was generally confined to the lower whorls but many recent infections were noted higher in the crowns. However, there were no recent infections on red pine in a Scleroderris plot in the Bayfield County Forest.

OTHER NOTEWORTHY DISEASES

Organism & Disease	Host	Location & Date
Chrysomyxa sp. Needle rust	Spruce, black	Sec. 32, T42N, R73, Vilas Co. 8-3-72
Melanconium oblongum Dying lateral branches	Butternut	Langlade Co., Pattison Ranger Station, Douglas Co. 9-28-72
Melampsora medusae Leaf rust	Aspen, trembling	Sec. 34, T42N, R3W, Ashland Co.,
Melampsorella caryophyllacearum Fir broom rust	Fir, balsam	Sec. 26, T45N, R13W, Douglas Co., 9-28-72
Phaeocryptopus gaumananni Needle cast	Fir, Douglas	Sec. 2, T22N, R4W, Jackson Co., 6-7-72

MISCELLANEOUS

Salt Damage

1972

Salt damage was severe on roadside white and red pine throughout the state.

1973

Road salt continues to damage roadside pines, spruces and even some maple and birch trees.

Winter Injury

1972

Winter injury to conifers was widespread over the state. Damage was severe on Scotch pine, white spruce and Norway spruce. White, red and jack pine were relatively free of damage. Spanish variety of Scotch pine was stunted and top-killed in west central plantations. Unidentified variety of Scotch pine, eight to ten feet tall, were killed in Lincoln County and monetary loss to Christmas tree growers will be substantial, especially in Lincoln and Langlade counties.

Frost Damage

1972

Frost on the morning of June 11 caused widespread injury to new growth on conifers and hardwoods in many of the northern counties.

Black ash, sugar maple, basswood, cherry, hazel, white spruce, balsam fir, red pine, white pine and Scotch pine are among the species that were injured to varying degrees. Injury was slight on aspen and elm. Hardwoods refoliated within a few weeks. However, the frost killed exposed portions of current year's needles which were half grown at the time. Symptoms were the same as those caused by air pollutants such as ozone or sulfur dioxide. Plots were established at three locations in Langlade County to evaluate the long term effects on the species mentioned. (Appendix C).

1973

No late spring frosts were reported in 1973. Data from plots established last year, however, show that a severe frost on June 10, 1972 killed 75 percent of the terminal shoots on recently planted red pine. This damage will probably result in multiple stems and the need for additional cultural treatment in the future.

High Water

1972

Extensive tree mortality occurred in several sections of spruce-cedar type north of Legend Lake in Menominee County. Trees have been dying the past three or four years, primarily because of high water. Salvage of the timber should be started in 1973 if the timber is to be utilized.

1973

Saturated soil and rising groundwater set the stage for local flooding of pine and hardwood timber over much of the state when unusual moisture conditions prevailed early in the growing season. Standing water was present in normally much drier pine stands and other timber sites during May and June. Its effect on the trees continued to become more evident as the summer progressed.

Red and jack pine in Adams and Wood counties were killed when tributaries of the Wisconsin River backed up. In Rock County white oaks over 100 years old were killed when severe flooding occurred along the drainages that go into the Rock River.

Jack Pine Mortality - Drought

1973

Jack pine branch and tree mortality occurred in Adams and Wood counties in the summer of 1973. The mortality appears to be related to adverse environmental conditions. Rainfall was light from June 17 to July 23 with high temperatures in the 80's and 90's. The fungus, *Diplodia pinea,* was observed fruiting in September on twigs that were apparently weakened by winter injury, drought and insects. In some areas many of the rootlets of affected pines were dead from weevil feeding.

Hemlock Mortality - Menominee County

1973

Hemlock mortality associated with drought, hemlock borers, *Melanophila fulvoguttata* and root rot, *Armillaria mellea* in Menominee County has totalled approximately six million board feet in the past 3 to 4 years. Most of this has been salvaged for use as lumber or pulpwood. The salvage of hemlock south of Bass Lake cleaned up one of the last major mortality areas in the county.

Pine Grosbeak Damage - *Pinicola enucleator* L.

1972

Pine grosbeaks caused an unusual amount of damage to Christmas trees in Portage, Waupaca and Waushara counties from January through March, 1972. In some plantations from three to fifty birds were observed feeding on the buds of red, white, and Scotch pine. In some plantations 44% of the buds were damaged making the trees unsalable as Christmas trees. Some Christmas tree growers applied for permits to shoot the birds but the permits were denied. The grosbeaks did not appear in the fall of 1972.

Mycorrhizae Studies

1973

Mycorrhizae nursery plot studies were established at the Pinney Nursery, Sturgeon Bay, Wisconsin by U.S.D.A., Forest Service, State and Private Forestry, St. Paul, Minnesota. Cooperating agencies were the Southeastern Forest Experiment Station, U.S.D.A., Forest Service, Athens, Georgia, the Wisconsin Department of Agriculture, and Wisconsin Department of Natural Resources. Red pine seedbeds were inoculated in June with mycelial cultures of *Pisolithus tinctorius* (Pers.). The plots will be evaluated by State and Private Forestry in 1974.

Mycological records indicate the only two collections of Pisolithus tinctorius in Wisconsin. Collections were made at Spring Green and the Dalles, Wisconsin in September 1910 by Edward T. and Susan A. Harper. A survey for the fungus was conducted in the fall of 1973 and it was found in two locations.
It was collected in white pine transplant beds at Griffith State Nursery, Wisconsin Rapids on October 20, 1973 by J. G. Berbee and was also collected in a year old red and Scotch pine plantation near Boscobel, Wisconsin (Sec. 18 or 19, T8N, R20W) on October 24, 1973 by A. J. Prey.

APPENDIX A
Red Pine Shoot Blight Damage Survey
by
Ray Weber & Stanley Banash [1]
November 30, 1972

Damage plots were established in 1972 to document the impact of this problem on young red pine. These were located in two different situations in Vilas County. Both areas have pole and/or sawtimber trees where lower crowns apparently have been affected by shoot blight for a number of years. Infection of planted reproduction in these areas appears to have begun in 1971. Data from these plots is summarized as follows:

Plot 1. Northern Highland State Forest - Starrett Lake, Sec. 24, T41N, R7E. Plantation established about 1956 in the understory and small openings of a pole-sized stand. Average tree height in the openings is 18 feet and suppressed or understory trees 8 feet. Plot size is approximately .1 acre (1/5 chain by 5 chains) extending through various size openings and understories. Distribution of shoot blight infection is summarized as follows:

Table 1. Red Pine Shoot Blight Incidence, 1972, Starrett Lake Plot (Sec. 24, T41N, R7E).

Tree Location	Trees (No.)	Average Height (Ft.)	Trees Dead (No.)	Shoots Killed (%)
Openings	49	18.1	0	21.2
Understory	51	6.5	10	85.1
Total	100		10	

Most of the suppressed non-crop trees will probably die due to a combination of shading and shoot blight infection. Trees growing well in the openings, by contrast, produce many more new shoots than the number being currently affected by shoot blight.

Plot 2. Uihlein Plantation - (NW¼, NW¼, Sec. 24, T42N, R9E, Vilas Co.) - 30 acres. This "old field" plantation was established about 1959 on a fairly good site. One large open grown sawlog red pine with severe "die-up" symptoms is located approximately thirty-five feet north of the plantation. (Scleroderris is prevalent and severe throughout the lower crowns over the entire thirty acre plantation. Individuals and small patches have apparently been killed by this fungus). Flagging of

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[1] Forestry Technician and Forest Entomologist, Wis. Dept. of Natural Resources, Antigo, WI.

1972 growth in the upper crowns became very conspicuous, particularly in close proximity to the large affected native pine. A permanent plot was established to measure percent and number of affected shoots along lines radiating outward three hundred feet or more in three directions from the plantation edge (Table 2).

Table 2. Red pine shoot blight incidence in a 13-year-old red pine plantation adjacent to an infected native 50-year-old pine.

Distance from Native Pine (ft.)	Direction (East)	(South)	(West)
	Shoots Infected (Percent)		
0 - 50	64	28	49
50 - 100	5	4	43
100 - 200	1	3	1
2200 - 300	1	1	1
300+ -	1	1	1

The percent of affected shoots diminished more abruptly to the east as compared to the south and west. This might be due to the screening effect of denser jack pine in that direction from the affected native pine. Thus far, no mortality has occurred except for a few natural seedlings close to the large sawlog tree. Plot readings will be continued in the future to evaluate the impact of both Scleroderris in the lower crown and shoot mortality in the upper crowns of the planted trees.

APPENDIX B

Mercury Levels in Trees Near Port Edwards, Wisconsin

by

Ron Becker & Allen J. Prey [1]

INTRODUCTION

Little is known about the levels and effects of mercury on trees. Studies in New Haven, Connecticut showed that mercury levels ranged 0.17 ug/g. in Pinus nigra twigs to 1.10 ug/g. in Tila cordata leaves (Smith 1971). The BASF Wyandotte Corp. mercury cell chlorine-caustic soda plant at Port Edwards, Wisconsin provided an opportunity to sample levels of mercury in trees growing near the plant. The estimated discharge from the plant was 3-7 lbs. of mercury/day up to July, 1971. Pollution abatement equipment went into operation in July 1971 and reduced the total mercury discharge to less than 5 lbs/day. The DNR has sampled snow, soil, vegetation (Konrad), fish and wildlife in the area (Kleinert & Degurse, 1972).

METHODS

In Wisconsin tree twig and foliage samples were collected in the vicinity of the Wyandotte Chemical Plant in 1971 and 1972 and were analyzed for mercury with an atomic absorption spectrophotometer at the Lab of Hygiene on an unwashed fresh weight basis.

RESULTS

Mercury levels of 1972 current year's foliage were usually lower than current year's foliage collected in October 1971. Samples of 1971 growth collected in 1972 also showed a decrease in mercury (Table 1). It is not known if the mercury levels in the vegetation are the results of uptake by the plant or from airborne mercury on the surface of the plant. Sampling will be continued in future years to see if mercury levels in the trees are correlated with the chlorine-alkali plant mercury discharge.

Literature Cited

Kleinert, S. J. and P. E. Degurse, 1972. "Mercury levels in Wisconsin fish and Wildlife." Wis. Natur. Resour. Tech. Bull. No. 52. 22 p.

Konrad, John. Mercury Reports on File, Bureau of Water Quality, Wis. Dept. of Natural Resources, Madison, Wisconsin.

Smith, W. H. 1971. "Lead, Mercury and Sodium Contamination of Urban Trees." Abstr. Phytopathology 6:912.

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[1] Air Pollution Specialist & Forest Pathologist, respectively, Dept. of Natural Resources, Madison, Wisconsin

Table 1. Mercury Levels in Vegetation and Soil - Wood County, Wisconsin, 1971-1972

Sample Location	Sample Description	Mercury (mg/Kg) Sample Date 10/25/71	 7/13/72
John Alexander School Forest-Port Edwards, Wis. T22N, R5E, Sec. 34	*Tilia americana* 6" DBH		
	1972 Leaves & twigs		.062
	1971 twigs	.07	.058
	1970 twigs	.10	
	Soil beneath surface vegetation		.037
	Pinus strobus L. 2" DBH		
	1972 twigs & needles		.060
	1971 twigs & needles	.44	.186
	1970 twigs & needles	.39	
	Pinus strobus L. 3" DBH		
	1972 twigs & needles		.188
	1971 twigs	.6	
	Soil beneath ground cover		.12
	Pinus strobus L. 10" DBH		
	1972 twigs & needles		.192
	1971 twigs & needles	.57*	
	Pinus banksiana 6" DBH		
	1972 twigs & needles		.192
	1971 twigs & needles	.4*	
	Rubus spp. - ripe berries		.011
T22N, R5E, Sec. 33, NW, NW	*Pinus strobus* L. 9" DBH		
	1972 twigs & needles		.029
	1971 twigs & needles	.025	
	Soil		.022
T21N, R5E, Sec. 16, NW, NW	*Pinus banksiana* 5" DBH		
	1972 twigs & needles		.0065
	1971 twigs & needles	.02	.012
	soil - exposed		.009
T21N, R5E, Sec. 2, SW¼	*Pinus strobus* L. 3" DBH		
	1972 twigs & needles		.0145
	1971 twigs & needles	.06	
	soil		.018
T22N, R6E, Sec. 31, NW¼	*Pinus strobus* L. 6" DBH		
	1972 twigs & needles		.014
	1971 twigs & needles	.045	
T22N, R6E, Sec. 27, SW, NW	*Pinus strobus* L. 20" DBH		
	1972 needles & twigs		.006
	1971 needles & twigs	.02	
	soil		.014

Table 1 (continued)

T21N, R6E, Sec. 2, NW, NW	Pinus strobus 18" DBH		
	1972 needles & twigs		.008
	1971 needles & twigs	.028	
	soil		.014

* Samples collected 11/6/71

APPENDIX C

Frost Damage - 1972

by

Ray Weber & Stanley Banash 1/

A late spring frost on June 10th caused severe damage to tender foliage on a great number of plant species in northern Wisconsin. Plots were established at several locations in an effort to evaluate the effect on future growth and mortality of several tree species. These were re-examined in late summer with results as follows:

Black Ash: (NE NW, Sec. 8, Langlade County) Foliage was completely killed on June 10th. All living crown area was completely refoliated by late June with no apparent damage to growth.

Northern Hardwood: (1970 K-G area on county forest, SE¼, Sec. 32, T33N, R12E, Langlade County) Damage was severe to foliage of sugar maple and hazel, moderate to basswood and cherry, and none to light on aspen and elm. Refoliation was generally complete within a few weeks and no permanent damage was apparent. The only exception was in recently treated cultural areas where sugar maple sprouts, as well as hazel brush, were killed. This may be beneficial where the purpose of the cultural work is aspen regeneration.

White Spruce and Balsam Fir: (Lincoln and Langlade counties) Damage was severe to the new growth of both species, particularly reproduction on lower sites. This has caused some growth loss. Also, possible damage to future tree form where the terminal was killed. This can be determined by plot examination next year. The severe frost also caused some shearing problems for Christmas tree producers, particularly in balsam fir.

Red Pine: (Parish Burn - Langlade County - Planted 1971 with 3 - 0 stock SW, SW, SE, NW, Sec. 17, T34N, R9E) No tree mortality was observed but all new growth was killed in many recently established plantations. Where terminals were frozen, numerous buds have set at the top of the previous year's growth. This will probably result in considerable forking or multiple leaders next year. Pruning to correct this growth malformation may be needed in the future. Established plots will be examined next year to determine the effect of frost damage on growth form.

1/ Forestry Technician and Forest Entomologist, respectively, Dept. of Natural Resources, Antigo, WI.

APPENDIX D

Injury to Young Trembling Aspen Stems - 1973

by

Ray Weber & Stanley Banash 1/

Injury to young trembling aspen stands was summarized in a report (S-72-4) August 1972, by Imants Millers, Northeastern Area State and Private Forestry, USDA, Forest Service. This exploratory survey was expanded in an effort to determine the extent of various injuries between two aspen regeneration methods; hand release and K-G blade treatment.

METHODS

Several aspen stands in Langlade County, clear-cut three years previously, were examined as possible areas for comparison of injuries in the two regeneration methods. It was soon obvious, however, that the great variation in site index made it virtually impossible to obtain any valid data comparing treatment methods. Only one area of similar site index (Section 14, T34W, R9E) part hand release and part K-G blade, appeared suitable for comparison. Methods used were essentially the same as reported by Millers and the same injury data was recorded.

Injury Classes:

Crook - fork, sweep, bend, bayonet; usually caused by top-kill, or reduced terminal growth allowing a lateral branch to become the dominant stem.
Canker - open wounds exposing wood; when healing occurs, the canker was considered as such until the cambium of the wound edges was fused.
Rough Bark - abnormal roughness on the bark; usually evidence of a healed canker
Swelling - abnormal growth of wood; bulging without evidence of canker.
Top-kill - terminal bud, or shoot, killed.

RESULTS AND DISCUSSION

The data analysis (Table 1) indicates injuries to be slightly less in the hand release treatment but the difference is not significant. Most types of injury in both treatments are also slightly less than reported by Millers. This may be due, however, to a site difference in the areas sampled. A controlled research study on similar sites and stocking would be necessary in order to evaluate the amount of suckering and type of injury by each treatment method. The major cause of top-kill in all regeneration areas examined appears to be Venturia spp. fungus.

1/ Forestry Technician and Forest Entomologist, respectively, Dept. of Natural Resources, Antigo, WI.

Table 1. Injury to aspen suckers three years after regeneration treatment in Langlade County (Section 14, T34N, R9E).

	Treatment								
	K-G Blade			Hand Release			Millers 1/		
	Crown Class 2/								
	Dom.	Int.	Sup.	Dom.	Int.	Sup.	Dom.	Int.	Sup.
				(Percent)					
Crooks and/or Cankers	80	72	99	87	79	99	94	90	100
Crooks only	53	41	76	59	50	82	88	74	87
Cankers only	67	86	90	61	54	80	56	55	88
Rough Bark	51	50	72	54	54	57	34	32	32
Swelling	10	10	30	7	13	24	3	0	31
Top Kill	29	28	22	30	28	29	38	32	40

1/ Millers, I. 1972. Injury to young trembling aspen stems. Report S-72-4. Northeastern Area State and Private Forestry, USDA Forest Service, St. Paul, Minnesota.

2/ Crown Class

Dom. - Dominant
Int. - Intermediates
Sup. - Suppressed

APPENDIX E
Native Elm Bark Beetle Brood Studies
Menominee County - 1972
by
Ray Weber

Objectives of Study

1. To evaluate use of elm slash for brood purposes in areas where salvage logging took place during the winter of 1971-72.

2. To compare this use between elm slash in different environments (Swamp Hardwood and Northern Hardwood types); also, between standing elms recently killed by Dutch elm disease and adjacent fresh slash.

3. To measure the flight of beetles from salvage areas to adjacent uncut northern hardwood areas with large volumes of elm sawlogs.

Methods & Materials

1. Square-foot tanglefoot boards were placed on elm slash in two different northern hardwood situations. Plot 1 was located where disease-killed residual elms were generally distributed throughout the type; Plot 2 were killed residuals were scarce or absent. In both areas, trap locations extended outward at approximately five chain intervals from a lowland type having large numbers of standing elms killed by Dutch elm disease. The number of trapped beetles was tallied at irregular intervals throughout the period May through August.

2. Beetle use of slash and standing dead elms was also evaluated by removing bark samples throughout the season and estimating the relative amount of brood galleries throughout the period May through August.

3. Traps were also placed on healthy elms (six feet above ground) starting at edge of elm salvage areas and extending into uncut NH type at approximately five chain intervals. Four traps were maintained adjacent to each salvage area.

Results & Conclusions

Beetles collected from traps on elm slash are summarized as follows:

Plot No.	Location	No. of Traps	Seasonal total beetles per Trap
1	T29N, R13E, S.29 & 32	8	14.7
2	T30N, R15E, S. 3	4	0.8

Trap collections indicated the peak flight of over-wintering adults occurred during the last week of May. Despite the high number per square foot in

Plot 1, subsequent examination of nearby slash showed very little use for brood purposes. The average use was estimated at only 15 percent in the Plot 1 area and 5 percent in the Plot 2 area. This compares to approximately 50 percent use of slash in the nearby lowland elm type. An occasional top in the upland was heavily utilized, but it was usually near a standing tree which was used for brood purposes the previous year. The heavier use of slash in or near the lowland was probably due to a high residual beetle population from previous years. Virtually every standing tree which died in 1971 and early 1972, both upland and lowland, was found to be heavily utilized. No evidence of beetle parasitism was noted at any of the observations during the season.

The most important conclusion is that standing residual trees killed by Dutch elm disease are a much greater hazard to disease spread than the much larger volumes of non-infected elm slash.

Traps placed on healthy elms in the uncut northern hardwood produced no significant data. Collections for the season averaged below one per trap in both areas. Flight from brood material to healthy elms for feeding purposes apparently takes place higher in the crown than the trap location. Besides, most of the emergence of adults from the abundant elm slash will not take place until the spring of 1973.

Phenological and Biological Notes:

Elm Salvage Area Logged During Winter of 1971-1972 - Sections 32, 33, T29N, R14E

This site provided an abundance of slash, stumps and residual elms. The potential for rapid increase of Dutch elm disease was great.

May 9 - Elm flowers were fully open and buds averaged 3/8" in length. An estimated 65% of the overwintering adults had left hibernation tunnels to feed or construct egg galleries. In suitable brood material they continued to burrow inward to feed and construct egg galleries between the bark and wood. This type of activity was noted in standing trees which had died in 1971, and in logs and large limbs of slash in low-lying areas and adjacent upland trees. Adult beetles appeared to be rare in slash and elms away from the lowlands.

Overwintering larvae were scarce compared to the numbers of overwintering adults.

Oviposition appeared to be just starting in a few galleries (less than 1%). Paired adults were common in newly constructed nuptial chambers. No eggs or nuptial chambers were noted in fresh slash from winter logging, but numerous adults appeared to be burrowing inward from hibernation tunnels.

Area southwest of Silver Creek - Sections 29, 30, SW¼, Section 31, T29N, R13E

Elms in this area were cut in 1970 to a 12-inch dbh limit.

May 15 - Elm leaves were up to ½" long in SW¼ Section 31. Most of the adults apparently emerged from the slash in the fall of 1971. However, many brood galleries still contained well developed larvae in trees logged late in 1970.

May 22 - Section 31 - Unusually high temperatures the previous week induced heavy beetle flights to brood material. (Between May 15 and 21 daytime highs at Antigo ranged from 73°- 88°F and averaged 83.7°. Low temperatures for the same period ranged between 41° and 51°F and averaged 46.2°F.) Eight tanglefoot traps, placed on fresh elm slash in the northern hardwood type, caught from 1 to 20 beetles per square foot and averaged 9 per square foot between May 15 and 22. Elm leaves attained full size during the period.

June 6 - Sections 29, 31 - Adult beetles continued migration to slash left from winter logging (1971-72). Tanglefoot-coated panels caught from 2 to 28 adults per square foot. Egg galleries and newly-hatched larvae were observed in some slash, but a majority of the adults were tunneling through the bark. Early symptoms of Dutch elm disease were commonly observed in residual elms under 16" dbh in the salvage area. Trees currently dying were already heavily invaded by beetles. These trees appear to provide a much greater hazard to surrounding healthy elms than population buildup in non-infected slash.

June 15 - Sections 30, 31 - First pupae, from overwintering larvae, were observed in standing trees which died in 1971. Tanglefoot trap collections indicated that the peak flight of overwintering adults to brood material occurred between May 22 and June 6. Traps averaged from 15 to 17 beetles per square foot of trap surface. Traps placed on living elms in northern hardwoods indicated that very few beetles flew toward them. Some traps caught no beetles, others had very low numbers of beetles. Examination of slash from the late fall cut in 1971 indicated little utilization of it as brood material. About 90% of the slash examined showed no evidence of beetle activity. An occasional top was heavily utilized indicating possible beetle preference for specific trees.

The American elm seed crop was generally heavy and well dispersed.

July 5 - Sections 30, 31 - No live beetles were found in abundant slash from 1970 elm salvage logging. However, old galleries and emergence holes were very numerous.

Oviposition by overwintered adults appeared to be at its peak in elm slash. Well developed larvae were present in early egg galleries. The first callow adults from overwintered larvae were observed. The population in this generation was very light compared to that of the overwintered adults and their progeny.

July 26 - Section 29 - Some overwintered adults were still laying eggs, but most of their larval descendants were well developed. Brood galleries were very abundant in standing dead trees and lowland elm slash. Utilization of slash in northern hardwood elm salvage areas was generally light. Adults from overwintered larvae have practically all emerged. This generation was very scarce compared to the overwintered adult brood.

September 1 - Section 29 - Descendants of overwintered adults were comprised principally of pupae, although some were still larvae, and some pupae had transformed into new adults. Overwintered larvae were mostly transformed to adults, some of which had laid eggs.

The following utilization of brood material was observed by sampling bark:

Lowland elm type - 95% of recently killed trees.
60% of slash from 1971-1972 winter logging.

Northern hardwood type - 75% of recently killed standing trees.
5% of slash from 1971-1972 winter logging.

Elm Salvage Area - Winter 1971-1972 - Section 3, T30N, R15E

May 17 - Numerous elm stumps, mostly in or near the lowland elm type, contained thousands of adults. They were concentrated in a zone of bark, which extended from the cut surface to about an inch below it, where they gathered to feed in the cambium area. No egg laying was noted in the zone. Entrance to the cambium region was apparently through the bark and not downward from the cut surface. Concentrations of beetles appeared to be either hibernating adults which had overwintered in the bark, or migrants which had been attracted to the cutting. Similar concentrations of beetles were not observed in comparable zones on first logs or slash in the vicinity.

May 19 - Approximately 50 stumps were examined in the swamp hardwood type, and a similar number in adjacent northern hardwood type. Tree mortality from Dutch elm disease was high in the swamp hardwood type. Drowned beetles were abundant in the sap flow on stump surfaces. Estimated numbers of beetles observed per stump ranged from a high of 225 on a 16" stump in lowland to none on stumps in the northern hardwoods. The abundance of beetles in lowland elm stumps was up to 25 times greater than on elm stumps in northern hardwoods nearby. Hundreds of beetles were observed in the bark of stumps in which little or no sap flow was present. Apparently they had entered for feeding and/or breeding, although no egg galleries were noted. Elm leaves were up to 3/4" long.

May 22 - Flight to brood material apparently was very heavy during the past week when temperatures had been way above normal. Eight tanglefoot-coated trap boards placed on fresh elm slash in the northern hardwood type had 1 to 20 beetles per square foot and averaged 9 per square foot for the collecting period between May 15 and 22.

August 9 - 60% of the progeny of the overwintered adults were still in the larval stage and 40% had pupated.

90% of the overwintered larvae had transformed to callow adults and the other 10% were mature adults in the process of making egg galleries, some of which contained eggs.